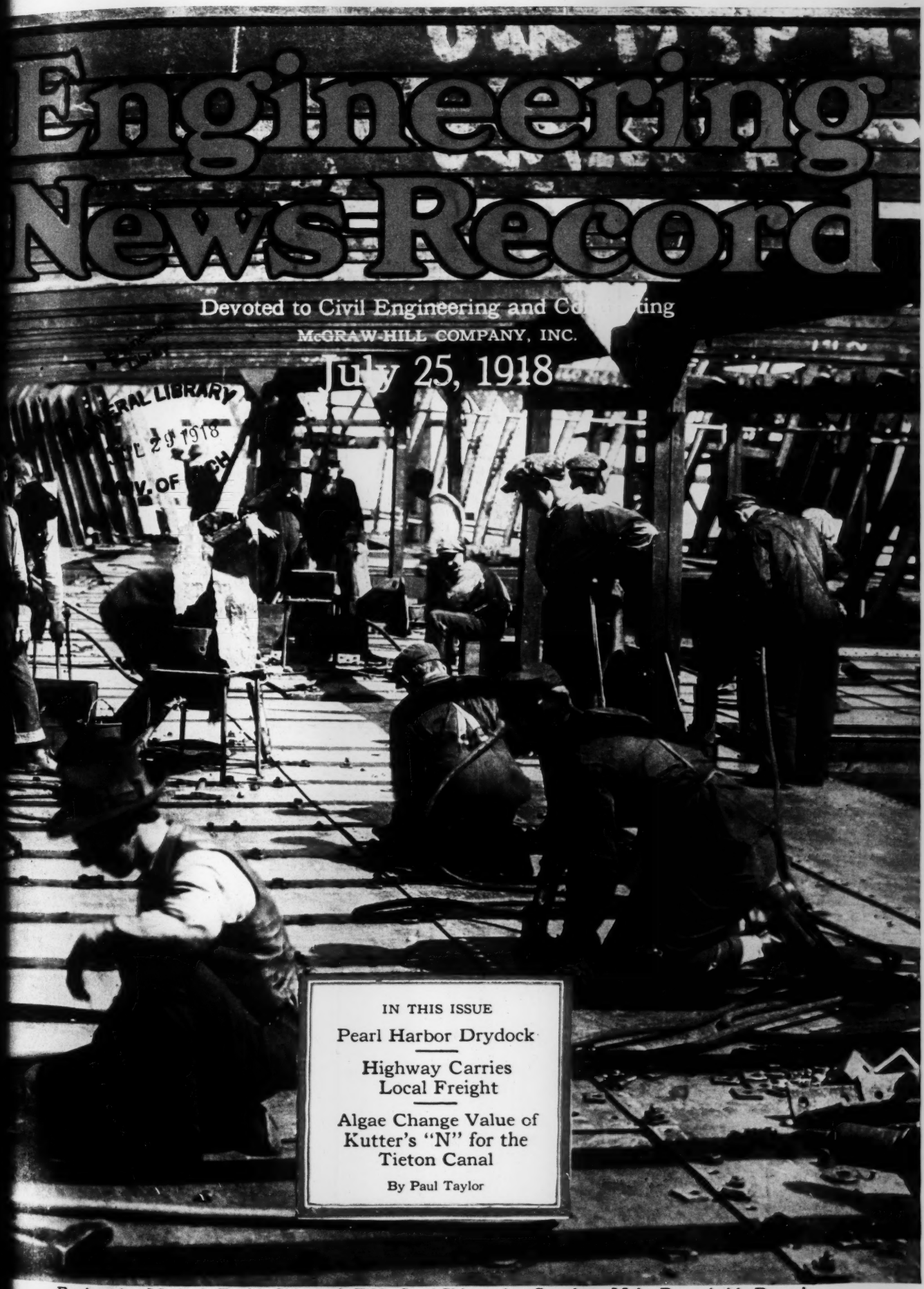

Engineering Methods Enable Skinner & Eddy Steel Shipyard at Seattle to Make Remarkable Records

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Volume 81 July 25, 1918 *Number 4*

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

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A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. Mehren, *Editor*

Charles Whiting Baker, *Consulting Editor*

Volume 81 — NEW YORK, THURSDAY, JULY 25, 1918 — Number 4

The Building Industries at Atlantic City

THERE was reported in the news column of this journal last week a convention of the building industries, called by the United States Chamber of Commerce to organize for the service of the Government. At it manufacturers of every kind of material that enters into construction work were ably represented. The makers of construction equipment were there. The master builders were represented both sectionally and nationally. But the professional men—the engineer and the architect—were conspicuous by the absence of every national society, save the electrical engineers and a member of the Engineering Council, who also represented other interests. And the general contractors—the men who build our railroads, our bridges, our industrial and manufacturing facilities, our highways, our municipal works—forming a group as important as the manufacturers, were represented by a few men who managed to seat themselves on beds and chairs in a single room of the hotel when they came together to discuss what part it was possible for them to take in this movement. Perhaps the Chamber of Commerce is not to blame. It was stated that every organization of which it could find a record was invited. And the few contractors who attended agreed that they themselves were to blame. They lack a representative, aggressive, national organization.

Research Into Society Aims

WHAT is the object of an engineering society? We recently recorded the starting by the American Society of Civil Engineers of a systematic inquiry into its objects, aims, and proper field of work. We also noted the appeal of Morris Cooke to the American Society of Mechanical Engineers that that society should more definitely, in its official code of ethics, affirm its duty to the public. Later Gen. William H. Bixby in his presidential address before the American Society for Testing Materials declared that engineering societies today have no longer the same objects to serve that were important when they were originally formed. Other interests have become much more important. He sums it up by saying that the importance of an engineering society today is to be judged by what it does for the general public, not by what is does for its members. Of course, the work done by any society in aiding its members to become more competent engineers, and in the establishment of standards and the improvement of practice is a service of great value to the public. The point worth emphasizing, however, is that this public service viewpoint should be kept in mind. As General Bixby pointed out, if an organization is merely looking after the pleasure and welfare of its own members, it should call itself a club, rather than a society or institute.

Water-Works Shutdowns and Sleepy Officials

RECENT shutdowns of two water-works plants indicate that the officials of some cities of the country need to bestir themselves to guard against accidents which may have dire results. In one case a city was without water for a day because lack of a proper valve system made it necessary to shut off power at the pumping plant to repair a broken fire hydrant, and the pumping plant failed to operate when an attempt was made to put it in service again. A wide-awake chamber of commerce committee made an investigation following this accident and pointed out the need of the addition of new valves and proper maintenance of those in existence—some of the latter being so corroded that they could not be operated. In the second city the pumping plant was stopped, it is stated, as the result of failure of the city government to advance wages of employees. Some of the operators appear to have refused to work, and one of those on duty is said to have quit because he was "fatigued" after running the plant continuously for sixteen hours. Although such action may well have been quite unexpected, the wide-awake city official is prepared for just such contingencies.

Politics and Garbage in New York City

OVERWEIGHT should not be given by those unfamiliar with New York City conditions to allegations that the reduction works which treat the garbage of the metropolis are so great a nuisance that they must either be closed or else, if their byproducts are wartime essentials, taken over by the Federal Government. Staten Islanders condemned the plant as a nuisance before it was built. The controversy over it has been, and apparently still is, mixed in politics. Whatever else happens the plant should not be shut down until competent disinterested engineers declare that it cannot be operated with reasonable freedom from nuisance. As to its being taken over by the Federal authorities, no evidence has yet been made public which proves that this or any other garbage-reduction works should pass into Federal operation.

Housing Problems Need the Engineer

SOMEONE, having in mind the potency of executive direction and the general need for brains, has recently made the cogent remark that an organization chart is not an organization. It is no less true that a chart fails often to represent the relative importance of the various men and powers it so neatly delimits. This is the case in both of the Government housing departments, where formal organization reduces to less than secondary rank the engineering branches which are spending nearly half of the money and which have today large influence on the programs of design and construction. Fortunately both departments have in their engineering heads men of great competence and strong personality. Both are gradually impressing upon their associates the responsibility that must fall to the engineering divisions.

Industrial housing is not new in this country, but it has been developed as a sociological rather than an engineering problem. Most groups of workmen's homes have risen little higher than the ordinary real-estate development, where engineering has consisted in laying out lines and grades and connecting the houses to the usual public utilities. The sociological problems have been studied by an earnest group of men who see quite clearly the social side of housing, who realize the needs for clean and healthy living conditions, who have a fair appreciation of real-estate economics, but who fail utterly to understand that the laying out and building of a town to house 5000 persons is an engineering problem of the first magnitude.

Next to the social reformers, the architect has been an important figure in the housing of the past. He adds to a possible understanding of the social side of the question a knowledge of the construction of the individual house, but as appreciating the economics of quantity production or the importance of the public-utilities design and construction, the architect is by experience and training little better fitted than is the social expert.

These two types of men have had large influence in Washington. Working behind the scenes and on full stage, they organized the housing operations of the Government with little initial consideration of the engineering necessities or recognition of the engineer's part in the work. In intentions if not in actual practice he was placed as an employee somewhere between the head bookkeeper and the chief clerk. There was no particular animus in this action; these men simply did not see in a housing development an engineering problem that could not be solved by subordinate employees. It is not necessary to outline the progress of the education that has taken place. The engineer is now an important figure in administrative conferences, his advice on economic questions is sought and the consideration of design and construction set up by his investigations play a large part in the selection of site and the type of development.

This better appreciation of the importance of the engineer in Government housing work should obtain also in the greater public and private developments that are sure to come. But the engineer must be awake, as many of them now are, to the fundamental social problems involved in the building of industrial communities. Only in this respect is the profession less well prepared than the two groups who are strenuously trying to control all future housing development.

All idealists are intolerant. Those who have made the matter of industrial housing a thorough study in the past few years are for the most part idealists, and they see in any criticism of their fine purposes the devil's hand of commercialism. This insinuation the engineer must fight. He will give ground to no one in fighting for the best of living conditions, but working as he is with the very skeleton and body of the city, he has a practicality of purpose which the more theoretical and specialized of his associates do not possess. Once the principles of good housing are accepted, the possibility of carrying through any development, not backed by the unlimited funds of a war-driven government, must depend on the engineer. It is he who must bring any scheme within the realms of economic possibility. Just now we are apt to forget profit and loss in the demands of the times, but these times will not always be with us. Relative costs of different sources of water supply and of different types of sewer and road construction, the choice between new utility construction on cheap land and existing utility use on expensive land, and, most important of all, the economies resulting from quantity production of houses—all are problems that only the engineer with construction experience can solve.

Opportunity for service to industry lies in the furtherence of this idea—the engineer's function in housing. Individually and collectively engineers should keep it in mind.

Confidence and Contractors

WAR conditions have made us realize more fully than ever that construction work cannot be carried on efficiently without confidence and coöperation between the contracting parties. On public work especially both the difficulty met in completing important highway and municipal work, requiring in one state the passage of three laws for relief; and the impossibility of obtaining reasonable tenders, which has forced the Federal Government to put all construction on a percentage basis, have convinced most of us that the fixed-price contract is open to improvement. While fixing the price to be paid, and attempting through specifications to fix the quality and time of delivery of the work, the old type of contract throws all the risk on the party least able to carry it, tempts the skimping of work to increase profits, furnishes a cause of disagreement, which is never wholly avoided, and retards the development of high skill in the working forces by making it profitable, at least for the time being, to hold down wages without regard to ultimate efficiency. Moreover, this method does not make the contractor's future depend sufficiently on his ability and reputation, leaving the field open to those who are undesirable and without experience. Its most serious defect, however, is that whereas the working force, the contractor and the engineer (representing the owner) should coöperate to produce the structure with the greatest economy, the fixed-price agreement assumes that the contractor will not produce the result with economy, sets the engineer to watch him, and

makes it profitable on the individual job to skimp the work and hold pay below the level at which greatest efficiency would be realized.

Neither is the cost-plus contract better than the fixed-price agreement in important respects. True, it throws the unforseen risks on the owner, who logically should carry them, and removes temptation to slight work or hold wages below the point of efficiency. It has many other advantages which make its choice for war work a wise one. But under it, it is still more necessary to maintain a duplicate organization—one to do the work, a second to watch the first lest it waste the owner's money. Manifestly such practice is due to a lack of confidence in the contractor, and prevents close coöperation between his forces and the engineer

Is there, then, any method of handling construction work which avoids these difficulties? The answer is found on page 118 of the last issue in an article which describes the workings of a system which is in common use abroad, and which has been most successful where employed on private work in this country. Mr. Fitch's article on page 125 suggests some detailed methods by which this system might be applied to public highway contracts, and a letter to the editor on page 191 shows how they are actually being applied to state bridge work.

There is no difference between the contract forms used in this and the cost-plus system, other than the penalty and bonus method of determining the fee. But there is a wide difference in the method of handling work and of selecting contractors. The contractor is assumed to be competent to produce the best results for the lowest cost, and is left entirely free to do so. Failure through incompetence or dishonesty is visited by his elimination from the business. Public works departments would keep performance records, as private owners are learning to do, and use them in common to select contractors with reputations for efficiency. The inexperienced and incompetent would be barred from tendering. No one could take work without having had adequate experience as a member or responsible employee of an established organization. In a short time such a contracting fraternity would be built up that any member could be depended on to devote his best efforts to any work he undertook. The rate of compensation would be proportioned to each one's ability and reputation, and would not be subject to risks. More efficient organizations would be built up, for it would be profitable to raise wages as long as the value of the work increased proportionately. The contractor's interest in doing the best work at the lowest cost would be so strong that a large "supervising" force to see that he did it would be a waste of money.

To put such a system into effect requires much more than the willingness of contractors. For some years they have worked to establish the system with private owners, and with indifferent success, when the volume of private work is considered. It is the owners and engineers who must travel the greatest distance to reach this goal; and of all owners, public agencies have farthest to travel. Graft and the suspicion of graft must be eliminated by swift and complete annihilation of the guilty parties. Laws and customs must be changed to extend unqualified confidence to the contractor as it is now extended to the engineer.

But the goal is not impossible. War has brought it much nearer; in fact, it is within reach, if we will undertake the necessary educational work, stand with a united front on the ground that the change is to the benefit of the public, whether as individual employers of contractors' services, or as public agencies of the community itself.

New York Must Not Interfere With Hudson River Bridge Projects

NEW York State has no authority to interfere with the construction of the proposed Castleton bridge over the Hudson River below Albany. This is the decision of the Supreme Court of New York, as reported in the news section of this journal recently, based on the grounds explained in these columns some weeks ago, that the Federal authority over navigable water is paramount, and may not be interfered with by any State.

The court reviews the history of the Castleton bridge project and shows that the Legislature of New York in 1913 passed an act authorizing the construction of the bridge with a span of 300 ft. When the railway company submitted its plans to the Federal Government (as it was of course obliged to do, the Hudson being a navigable river) the War Department engineers ordered the span increased to 600 ft. Authority for the construction of the bridge was also granted by a special act of Congress. The New York authorities then attempted to interfere, and the Legislature of 1917 passed an act which repealed the act of 1913 (under which, by the way, the railway company had already spent more than $350,000) and ordered that the proposed bridge if built must cross the river by a single span of about 1000 ft. This year the Legislature sought to clinch its control by enacting a law which makes the approval of the State engineer and the State superintendent of public works requisite to any railway bridge across the Hudson River, and requiring any such bridge to have but a single span.

Judge Chester, who writes the decision, shows clearly the specious nature of the State's claim that it has a right to add its restrictions on such work to those which the Federal Government might impose. The Federal authority rests not merely on its control over navigable waters, but on the fact that Congress has the paramount right to regulate interstate commerce over highways, railways and bridges as well. The interstate character of the proposed bridge, which New York State's attorneys attempted to deny, Judge Chester evidences by quoting from Secretary Baker's opinion, in which he said, "The connection between New England and the West necessitates bridging the Hudson, and the proposed bridge will be of great value to the country in facilitating the handling of freight to and from New York City."

The decision is, of course, subject to appeal to the higher State courts if the New York authorities see fit to spend time in that way, but there is small chance that any courts will undertake to reverse a decision so well fortified; and in any event, the ultimate authority lies with the Federal courts, who would probably make short work of such a belated attempt to limit the Federal authority.

Seattle Shipbuilders Overcome Pioneer Difficulties and Set New Speed Records

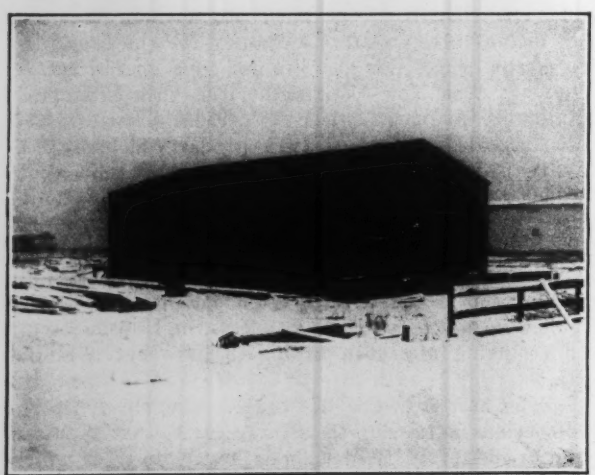
Inadequate Plant Does High-Speed Work—Persistent Expediting of Material—Labor Problems Solved—Large Punch Shop Does All Plate Work—Two New Machines Used

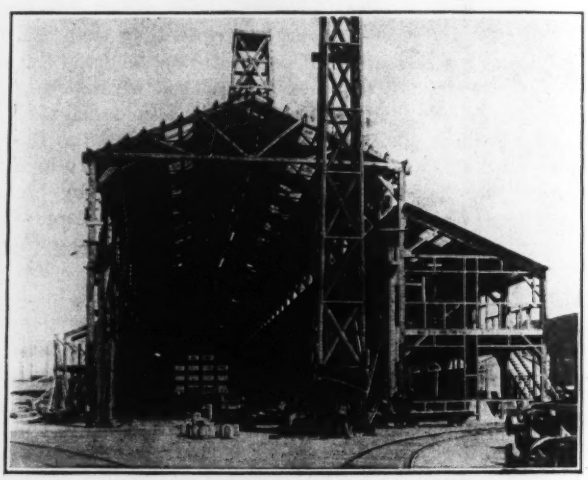
By Claude A. Osier
Seattle, Washington

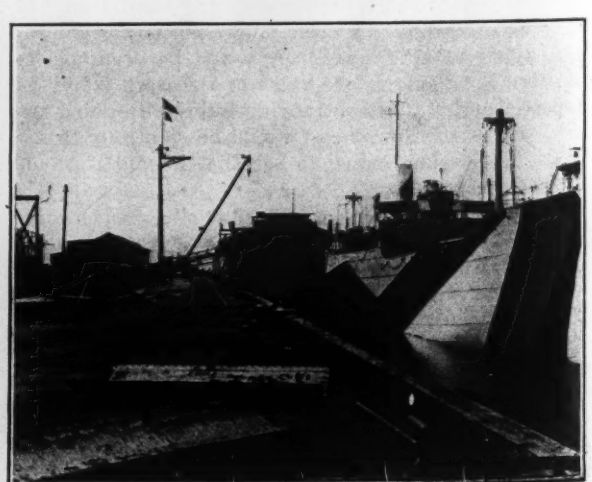
NOT much more than two years ago the shipbuilding plant of the Skinner & Eddy Corporation occupied an acre of ground on barren tide-flats. Today it is in the heart of Seattle's shipbuilding and ship industry district, and covers a ground area of 25 acres; indeed, with the recent acquisition of the Seattle Construction & Dry Dock Co. a total of 55 acres is included in the corporation's shipbuilding plant. In the intervening period the name of Skinner & Eddy has become familiar to the entire industrial world. The company has set the pace for shipbuilding in the United States. It has created new records for speed in ship construction and launching while expanding, building and rebuilding a plant which was originally designed to construct two ships for the company's own use.

What the remarkable performances of the corporation mean as human achievements can be more fully appreciated when it is understood that the plant is inefficiently laid out and inadequately equipped, and that practically none of the employees who have contributed their share in making the records were shipyard mechanics prior to their connection with the plant. They were green hands, who have been trained in the art of shipbuilding at the Skinner & Eddy yard.

In the rapid growth of the shipbuilding industry in the Northwest under the emergency conditions of the past two years the demand for men far exceeded the supply. To overcome this difficulty the company trained men for the various kinds of work involved. The result of this method of developing workers is that within the







ORIGINAL BUILDING OF SKINNER & EDDY PLANT, AND PARTS OF THE PLANT OF TODAY

past eight months the riveting strength has been increased from 80 gangs of riveters to 320 gangs.

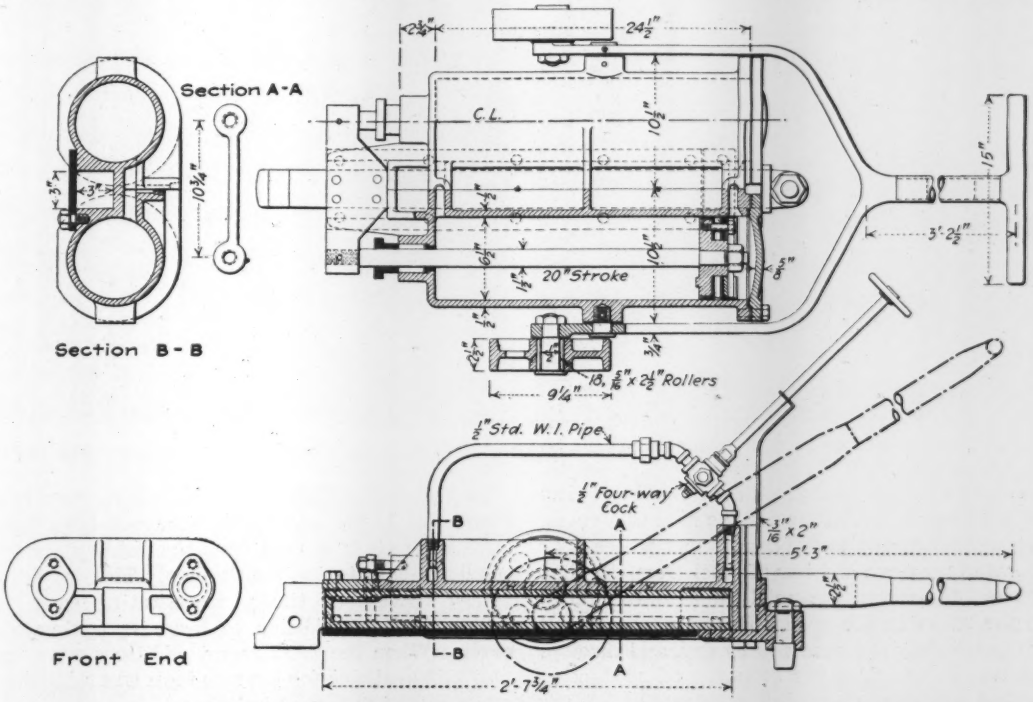
That the plant is by no means a model in its layout and equipment follows naturally from the manner of its growth. As the demand for space increased more and more, the yard frontier was gradually pushed east and north, by literally lifting up fences and setting them back, a few yards at a time. At one point a new though temporary building was erected, at another an additional story was tacked on—all in a frantic effort to make the plant keep pace with the ever-increasing shipbuilding program. As new property was acquired, old buildings thereon were remodeled and used for whatever department was in most need of additional space, often regardless of whether the new location bore a proper relation to that of other departments or not. All this had to be done, and still must be done, without in the slightest degree slowing up the ambitious shipbuilding program outlined. The main idea is to build ships, and build them at the highest possible rate of speed

The success of the yard cannot be ascribed to its plant layout or equipment, or to new methods of ship construction; it must be attributed to the owners' recognition of the absolute need for ships and their determination to allow no obstacle, however large, to impede progress. When a keel is laid a date is set for the launching of the completed vessel, and it then becomes the ambition of each individual engaged in work on that ship not only to meet the date set but to cut the time down a day or two. This must be done, however, without interfering with work on other ships under construction at the plant, and without taking men off those vessels. The aim is not for individual records but for the greatest output of ships in the shortest possible time.

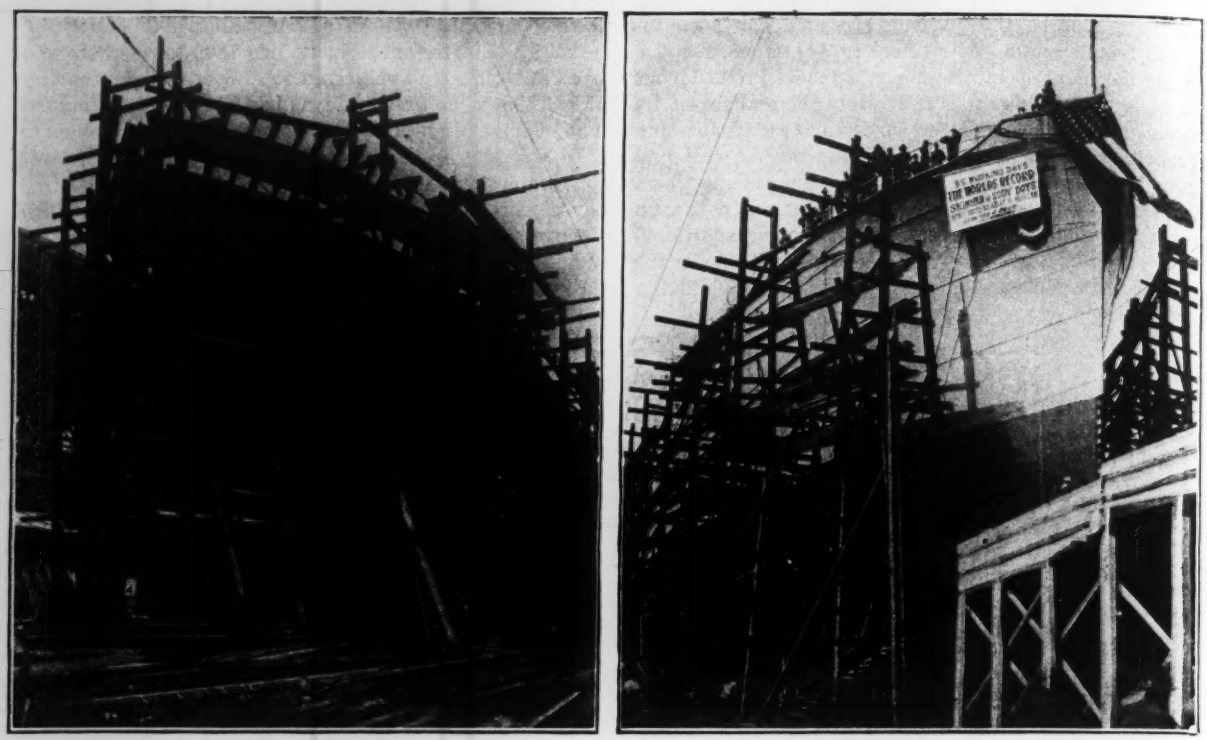
Since breaking ground for the plant, on Feb. 14, 1916, the company has constructed and delivered 26 steel ships —three 10,000-ton oil tankers, one 7800-ton and twenty-two 8800-ton cargo vessels, a total dead-weight tonnage of 231,400. The first keel was laid May 2, 1916, and the first completed ship delivered Sept. 21 of that year.

During the first year's activities the best time made for completion and delivery of a vessel was 162 working days. This time has gradually been cut down until today the average time for building, launching and completing a ship is 75 working days. The outstanding record of the company was made on the "West Lianga," which was built and launched in 55 working days, and was completely outfitted and equipped and turned over to the United States Shipping Board in 67 working days. This record feat in steel ship construction can be better appreciated when it is realized that in pre-war ship construction from seven months to a year was usually consumed before a vessel of this size was even launched. The last four ships built by the company have been constructed, from laying of keel to launching, in 55, 57, 56 and 55 working days, respectively, which proves conclusively that the record of the "West Lianga" was not a spasmodic effort to break records, but is an actual possibility for a regular pace.

Perhaps one of the strongest factors in the plant's success is the foresight demonstrated by the company in arranging for an uninterrupted flow of material to the plant. Never since the plant has been engaged in the construction of ships have the working forces been held up for want of materials. Shipments of steel, necessary equipment and apparatus from Eastern manufacturing centers to the warehouses and storage spaces of the company have been continuous. Before a ship had been sold or a contract signed, the company had placed orders for materials for 40 steel ships. It now has



PNEUMATIC FRAME BENDER DESIGNED AT SHIPYARD REDUCES LABOR AND SAVES TIME



STEAMER "WEST LIANGA," BUILT IN SIXTY-SEVEN DAYS—VIEW AT LAUNCHING AND TWELVE DAYS BEFORE

contracts with Eastern manufacturers for steel and equipment covering its activities for the next two years.

The company maintains a steel department whose duty it is to follow every plate and bar of steel from the time the order sheet is written out until the actual material is laid in the racks in the yard. Every piece of steel rolled for the company is traced day by day, and through representatives at the mills the sequence of production is maintained as required in the construction of the vessel.

Unprecedented steps have been taken to make certain that equipment would not be delayed. For instance, when lack of transportation facilities recently threatened serious delay in delivery of equipment and materials the company purchased 300 freight cars for its own use. Again, to facilitate quick delivery of one of the record-built ships the corporation secured special-train delivery of turbines from an Eastern concern, by fast freight. In another instance, to overcome a shortage in auxiliary equipment for another record vessel, a freight train carrying pumps en route from an Eastern factory was halted at a point in transit and certain portions of the pump were transferred to express shipment, thereby expediting delivery of the vessel to the Shipping Board.

As a result of the showing made in the rapid production of ships, and the requirement of the Government for the largest possible tonnage in the least possible time, arrangements were made in April for the lease of the Seattle Construction & Dry Dock Co. plant, operated by the Todd Shipyards Corporation, and placing it under the management of the Skinner & Eddy Corporation. On June 1 the latter took possession of the property, and without appreciable interruption put into operation the system existing at the original plant.

In the first Skinner & Eddy plant, now known as Plant No. 1, the hull material moves from the layout shop, where it is marked from the mold-loft templets, by small flat-cars to the punch shop. This latter has outgrown itself four times, necessitating each time the building of an addition to keep its equipment under cover. When the most recent additions were made the only site available for the new tools was a hundred yards away from the parent building.

The punch shop is in a sense the heart of the shipbuilding plant, as upon its capacity to fabricate the steel depends the speed of erection; enough bolters-up and riveters can be worked upon the ships and assembling floors to handle the plates and bars as fast as they can be delivered from the punches. This shop is served by monorail trolley hoists, which distribute the material to the various machines and assist the punch cranes in handling it while it is worked. The entire plant has six trolleys, two bridge cranes and eight locomotive cranes. Five industrial locomotives and six storage tractors transport steel and equipment from the various storage yards and warehouses to the shipbuilding berths.

Besides punching, the shell plates require scarfing at the corners where joints intersect. The engineering department of the company designed and developed a portable scarfing machine which can be clamped to the edge of the plate by means of setscrews and cuts a truly machined scarf of the desired width and length in about 15 minutes.

Frame bars which require bending to suit the form of the ship are heated in oil-fired furnaces and bent on the usual cast-iron bending slabs before they go to the punch shop. Here the bending is not done by the ordinary hand procedure of squeezing the bar against the

form with a crescent-shaped "crowder" handled by half a dozen men. Instead, the bending is quickly and neatly accomplished by a small portable double-cylinder pneumatic ram operated by one man. (See drawing.) This machine, designed at the plant, has produced a 40% increase in the output of the bending slabs.

From the punch shop, flat-cars carry the fabricated material to positions under the ship-erection cableways. All hull material is handled to place in the ship by cableway. As now used, there are two cableways over each berth or ship. The masts carrying the cables are about 100 ft. high and 486 ft. apart. Power is furnished by double-drum friction-drive winches operated by 25-hp. direct-current motors. The load line is two-part, of ⅝-in. plow steel, and has a hoisting speed of about 75 ft. per minute with normal load of 4000 lb. The transmission cable is continuous, passes over an elevator sheave, and has a normal travel speed of 300 ft. per minute. These cableways can handle about 75 tons of material per day, and if used to the utmost capacity would take care of the entire material of one vessel in about fifty days; each hull involves about 3600 tons of steel. Electric bells are used as a means of communication between the signal man on the slip and the winch man at the head of the slip.

The aërial system, while not original in shipbuilding work, was first applied by the general manager of works, David Rodgers, on submarines, and was later adopted by him for ship construction in the Skinner & Eddy plant.

Realizing that air supply in a shipbuilding plant is intimately related to the speed and efficiency of hull erection, the corporation has taken every precaution to insure sufficient and continuous air supply. There are two power houses, of which No. 1, situated at the head of the fitting-out wharves and to the north of the building slips, is the main compressor plant; this serves also as distribution point for all electric lights and power feeders to various departments. It runs 24 hours per day, the load varying from full capacity during day shift to approximately 3000 cu.ft. per minute demand on the midnight shift. Power house No. 2, at the south side of the yard, is used only during the day shift, when the maximum demand occurs. The main station contains seven units of total capacity of 10,350 cu.ft. free air per minute; this equipment will soon be more than doubled by adding five compressors, totaling 14,310 cu.ft. capacity. The other station contains four units, totaling 5700 cu.ft. capacity. Each compressor has a receiving tank of 315 cu.ft. capacity, except in the case of the largest duplex compressors, which are provided with two receivers. These are supplemented by the capacity of lines in the distribution system, which has about 1500 ft. of 12-in. main supplying 6-in. branch lines to the slips and fitting out wharves. The air is delivered to the mains at about 105 lb., and reaches the tools with a drop of from one to five pounds

Plant No. 2, which has an equipment of about 7300 cu.ft. capacity, is not adequately provided as to receivers or distribution system, and considerable pulsation and friction loss occur. The deficiency is being remedied as rapidly as possible. Arrangements of piping are being made so that all power houses can be cut in on the same lines. With contemplated additions the plants will have a combined capacity of about 37,500 cu.ft. of free air per minute. This will provide one or two large units in reserve in case of failure of another set.

During the first year the plant was in operation the machine shop occupied a space of 40 x 100 ft. Outgrowing its quarters, it was then moved to an old building formerly used by a structural steel concern. To meet the multiplied demand this department is about to move to a new shop building, the only modern one in the plant. The new structure is 100 x 250 ft., with a balcony in each wing, giving a total of 40,000 sq.ft. of floor space. Two overhead cranes of 30 and 10 tons capacity will handle the work.

Continuous with the machine shop building and forming a part of the same structure is the foundry, 125 x 250 ft., which is equipped with two cupolas, having a combined capacity of 30 tons per day. The company operates a smaller (15-ton) foundry outside of the plant.

Other departments are the pipe shop, copper shop, galvanizing plant and sheet metal shop (all under the direction of one superintendent), electrical shop, joiner and carpenter shop, pattern shop, blacksmith shop, fit-

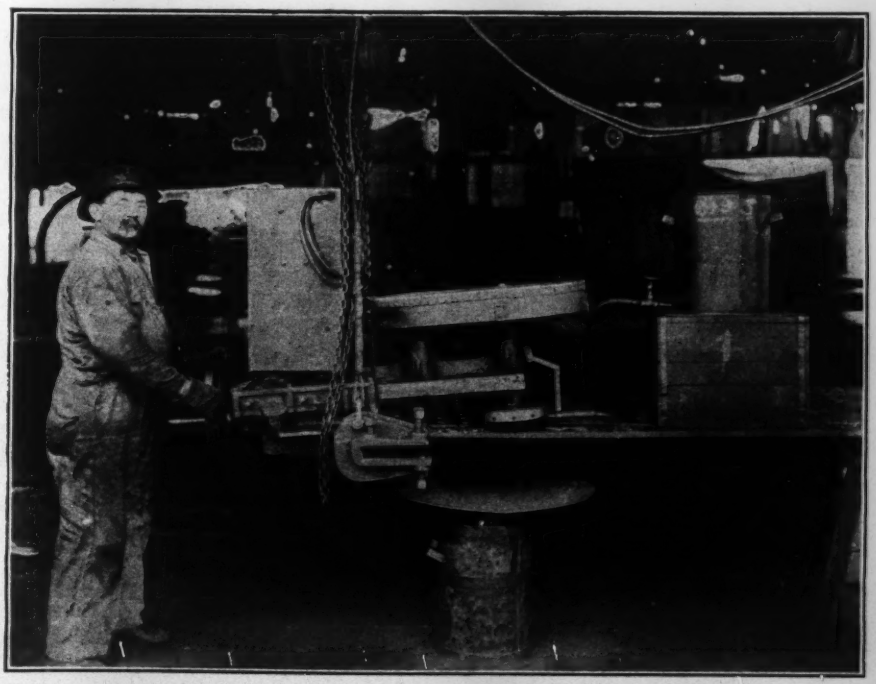


PLATE SCARFING DONE BY HOME-MADE PORTABLE MACHINE

ting and riggers' shops, and installation department. Workmen from the latter get onto the ship as soon as the tank tops are laid, and begin installing the pumps and other machinery. This work proceeds so that on the day of the launching the machinery spaces are practically finished, except for the engines and boilers themselves, which, owing to their size, cannot conveniently be placed in position while the vessel is on the stocks.

On each hull there is employed total power equipment of 700 hp., and the working force includes 48 riveters, 30 chippers, 50 holders-on and 70 drillers. The combined plants employ 12,500 men, to be increased to 13,500 shortly.

The plant contains three fitting-out slips with a total frontage of 3000 ft. There is one pair of sheer legs of 50 tons lifting capacity, standing 110 ft. above the wharf level, and in addition there are numerous locomotive cranes running along the face of the dock for use in installing the smaller parts of the ship equipment.

At various points in the yard steel bars and plates and other material are stored in racks, all being handled by means of locomotive cranes. Ten spurs enter the plant from main railroad lines and the yard is interlaced with a system of tracks for the locomotive cranes. In all, there are about five miles of standard-gage tracks in the yard.

Vessels at present under construction by the company are of what is generally known as the three island type—a well-decked vessel with poop, bridge and forecastle houses disconnected. Contracts have been signed by the company to construct several shelter or flush deck ships for the Emergency Fleet Corporation.

Each of the two plants has five ways. At present Plant No. 1 is launching vessels at the rate of two per month, or approximately 18,000 tons shipping capacity. With the improvement and rearrangement of Plant No 2 the corporation will be able to launch one 8800-ton steel vessel each week.

Working Organization of the Plant

A remarkable working organization has been built up, with a trained man at the head of each department, acting under the direction of David Rodgers, general manager of works. Mr. Rodgers has been able to inspire an unshakable feeling of confidence among the superintendents and foremen and men. He does not direct the activities of the plant from his office, but is constantly on the job, advising, suggesting, directing. He is the absolute construction head of the corporation, and the owners of the plant never question an order that he gives or a plan that he contemplates carrying out.

To encourage the superintendents and foremen, and to show them that their efforts are appreciated, the corporation gives them bonuses when a vessel is launched; this is in lieu of overtime. The employees are given double time for overtime, but the foremen work early and late without being recompensed according to the union scale. The corporation has maintained the best relations with its employees, and work has never been delayed by labor troubles. The spirit of harmony and coöperation is a prime reason why the plant turns out ships at a record-breaking pace. When all other Seattle shipyards were tied up by strikes about a year ago, this one continued building ships.

Once a day, usually after 5 p.m., the various superintendents and foremen congregate for discussion of the day's work. Actual production of that day is outlined and the following day's activities are planned. The General Manager of Works attends these meetings, checks up the progress of the work, makes suggestions, and gives orders. At noon each day, officials of the company, including both President Skinner and Vice-President Eddy, meet with the various department heads at luncheon at the plant's restaurant. Here plans are laid for the succeeding 24 hours' work, and the various difficulties arising are freely discussed. These noon luncheons and discussions obviate the necessity of long private conferences and telephone conversations. They also bring the heads of the various departments and the officials of the corporation more closely together, assuring unity of action.

The following men direct the affairs of the corporation: D. E. Skinner, president; J. W. Eddy, first vice-president; J. G. Eddy, treasurer; H. G. Seaborn, second vice-president; Victor K. Elfendahl, assistant to president; David Rodgers, general manager of works; C. N. McCallum, chief engineer; James Barclay, naval architect; M. H. Keil, consulting naval architect.

Crops Thrive Under Imhoff-Tank Sludge Tests at Dallas

Fertilized Cotton and Corn Twice as High as That Unfertilized—Soil Lightened and Evaporation Lessened—Farmers Interested

By Charles Saville
Director of Sanitation, Dallas, Tex.

Application of Imhoff-tank sewage sludge to crops at Dallas, Tex., promises to give good results. The sludge from the Dallas Imhoff tanks, as it flows out of the sludge chambers, has the appearance of heavy black molasses. It has a very slight, and quite unobjectionable, odor of burnt rubber or coal tar, noticeable only at a distance of a few feet. After drying for about a week on the drying beds, the sludge is easily spadable, and is removed in small cars to the dump, which is located a few hundred feet away on the low land bordering the river. This dump has been in use for over a year now, and there never has been any disagreeable odor around it. Weeds do not grow on the dump, but some tomato plants have developed. The sludge has a low water content, and it is light and easy to handle.

Last summer a small amount of the sludge was removed by a few farmers to be used for fertilizer, with excellent results. Early in the present year it was decided by the city sewer commissioner to make a practical test of the fertilizing value of the sludge, and several acres of ground adjacent to the Imhoff tanks were set aside for this purpose. The soil was rather poor, being a sandy loam, which hardens easily under the action of the sun during the long, dry summers. The land was divided into four sections, and planted with peanuts, black-eyed peas, corn and cotton. Half of each section, amounting to one acre, was thoroughly fertilized with about 85 cu.yd. of the dry sludge, which was plowed in and harrowed before the planting.

In this connection, it is interesting to note that Imhoff-tank sludge, on account of its friable and porous characteristics, is especially adaptable for mixing with hard soil, as it not only helps to fertilize the crops, but at the same time keeps the top soil porous and thus prevents evaporation. This is particularly important in hot, dry climates.

The Dallas sludge-utilization "farm" was visited by the writer several weeks after the cotton and corn had been planted. Well-defined lines could be seen separating the sections which had been fertilized with the Imhoff-tank sludge from those which had not been so fertilized. Only slight differences were noticed in the areas devoted to peanuts and black-eyed peas, which had been only recently planted, but the fertilized cotton and corn showed up very much better than that which had not been fertilized. The fertilized corn was not only twice as high as the unfertilized corn, but it had a much greener and more healthy appearance.

The farm superintendent says that the surface soil in the sections which have been fertilized does not pack and crack under the action of the sun nearly as badly as the soil in the unfertilized sections. Next year the superintendent is going to do his fertilizing early in the winter, plowing the sludge well into the soil and cultivating it two or three times before planting. He thinks this will further improve the present excellent results.

Farmers owning land in the vicinity of the sewage-treatment plant are watching the experiment with much interest, and it is expected that next year there will be a decided increase in the amount of sludge taken by them for use on their own farms.

Two points of advantage of Imhoff-tank sludge over the sludge from plain settling tanks are that it does not attract flies so readily, nor is it considered so dangerous from the standpoint of containing possible disease germs.

The writer hopes to make a further report on this matter later in the summer after the crops have been harvested. He takes the liberty of suggesting that similar reports be submitted to *Engineering News-Record* by observers at Atlanta, Ga., and other places where the result of experience with Imhoff-tank sludge utilization is available.

The Immediate Needs of the Railroads

Temporary Storage Tracks Must Be Built, New Locomotives and Cars Rushed to Completion and Present Equipment Repaired Beyond Last Year's Standards if Record Congestion Is To Be Avoided Next Winter

By Former General Manager

UNLESS vigorous action is taken in the next three months to remedy certain defects in our steam railroad system, the worst traffic congestion ever known will occur next winter. The demands for transportation will be the greatest ever experienced, and while the Government has done much excellent work in its reorganization of the railroads, this reorganization has practically monopolized the first six months of the year and set the roads back that long at a time when it was doubly important that their development programs proceed. The most urgent needs are for rolling stock—which calls for both the completion of all new locomotives and cars possible and the repair to a higher state of efficiency than prevailed last year of existing locomotives—and for large temporary storage yards in the vicinity of traffic centers, to keep surplus traffic off the main lines. To fill these needs there must be adopted a constructive program for obtaining the labor and materials required in the face of unprecedented demand for both for other purposes.

The capacity of our railways in normal times to handle adequately the fall and winter traffic, such as products of agriculture, the ordinary supply of fuel, the winter stocks of merchandise and the countless other commodities, has been taxed for years to the limit and far beyond, resulting in congestion, delays, loss of money and suffering, even loss of life. The normal traffic is now augmented by the added traffic necessitated by the war and its activities. It is safe to assume, therefore, that the demands for transportation which will be made upon the important arteries of commerce will be from 30 to 40% greater during the season fast approaching than the heavy traffic of last winter, the difficulties encountered in the handling of which are so well known that repetition is unnecessary. And this traffic due to war activities, such as the movement of troops and their equipment, supplies for the Army at home and abroad and for the allied governments, the materials for the building of ships, construction of docks, wharves, Army and Naval bases, all demands prompt and expeditious handling.

It is a well-known fact that during the past year the facilities of transportation have not been materially increased, and a careful survey will reveal the astonishing fact that, taking depreciation into account, the actual capacity for "moving the traffic" is not as great as it was a year ago. The railways were taken over by the Government on Jan. 1. The past seven months have been devoted almost wholly to reorganization of the operating staffs of railways under Federal control, and the result of such reorganization has been toward a centralization of extensive mileages, the result of which may be to multiply the difficulties, rather than expedite the prompt execution of plans under former methods of operation. The difficulties of organization have been further complicated by a rearrangement of staff whereby many men long in the service in official capacities have either had their authority removed entirely, new men being placed in their positions, or their authority so curtailed as to preclude the prompt, decisive action so necessary in transportation.

There has been some good work accomplished during the past six months in the unification of railway facilities. The word coördination has, however, been worked

beyond its "limit of elasticity" in many instances. As an illustration, the railway lines entering Jersey City are so radically different one from the other in the character of their traffic that a common use of their terminal facilities has its limitations. One road may be a heavy coal carrier, another a heavy carrier of merchandise, another a heavy carrier of grain. Each road has its distinctive character of terminals to meet its peculiar traffic needs. The absurdity of attempting to use the terminals of a coal road to handle merchandise or grain, or vice versa, is at once apparent, and serious errors have been made in attempting to unify and use in common, facilities that do not "fit the traffic."

The amalgamation of extensive territories of lines under one directing and authoritative head has reduced the necessary element of supervision, which is the most important element in successful transportation, and to this extent, at least, the efficiency of the transportation has been weakened. This error, if it proves to be such, will be evident during the approaching season. It would have been far wiser to add to the supervision and authority of limited territories than to take from it, as every one experienced in transportation knows is an axiom. The rules applicable to commercial concerns, including Governmental departments, do not apply to railway administration when the activities are scattered and the need of constant and wide-spread supervision is a requirement of successful operation.

Budgets Delayed

On all well-regulated lines of transportation in the past the practice has been to prepare a budget, have same approved and the work all planned and under way covering all improvements, additions and betterments and extensive repairs on the first day of January. This important matter has of necessity been delayed considerably, due to the transfer from private to corporate or Federal control of operations, and it is most unfortunate that almost six months of valuable time has been lost, when time was the most important element in providing the needs of transportation so vital in carrying on the war activities. The result necessarily must be that the added facilities authorized and provided for this year will scarcely be completed to add much to the sum total of facilities to meet the increased demands for transportation.

Its terminal facilities are the heart of a transportation system. If the terminals are inadequate to handle the traffic currently, then congestion follows, traffic is set off between terminals, the arteries become clogged and the system fails to perform its functions properly. There is scarcely a dense traffic line which cannot currently handle its traffic between terminals, and a considerable increase, if only the terminals are kept open; and the verdict of every experienced transportation official will be that the terminal facilities of nearly all, if not all, the dense traffic lines will fix the ultimate limit of handling the enormous traffic of next season.

Thus far this year little has been done to meet this deficiency. Much can be done during the next three months if the matter is wisely and vigorously handled by experienced operating men. The one thing most needed is large temporary storage yards, where little or no grading is necessary, in the immediate vicinity of large traffic centers, where surplus traffic can be stored and kept out of working yards and off the main lines, where it congests and interferes with the current movement of live traffic. Such facilities can be provided in limited time and with minimum expense, and removed when the war is over.

Locomotives and Cars, New and Old

Next in the order of importance to handle the maximum of traffic is adequate and well-maintained locomotive equipment. Owing to the necessity for furnishing locomotives for war purposes to our allies, the orders for American roads last year were canceled or deliveries delayed, or in some instances where orders were filled the locomotives were diverted to other roads than the owning lines. The orders for new locomotives for the current year have been seriously delayed owing to changes in design, delays in approving budgets and other causes. This will make only a portion available to handle this season's traffic.

One of the most serious questions confronting the railways at the present time is the condition of the power now in use. During the past winter locomotives were run beyond their economical limit of efficiency, because of the shortage and inefficiency of labor, the lack of materials and the heavy traffic, which demanded the use of power not adequately maintained. Lack of shop labor due to higher paid wages in other industries has made it impossible to restore the condition of locomotives and equipment to their necessary standard, the result being that on most lines of heavy traffic the power will go into the heavy season's work less efficient than it was a year ago. A large part of the new equipment will have to make good the deficiency.

The imperative need, therefore, for the next three months is a maximum output by locomotive works of new engines, and an intensive plan of repairs to such locomotives as can be repaired and placed in good condition. In order to accomplish this latter result, a drastic and constructive plan must be adopted to furnish the necessary labor and material; otherwise the penalty will be engine failures far beyond last year's enormous total, and resultant congestion of traffic.

An adequate supply of freight cars is the next item in importance necessary to handle the maximum traffic. The same observations made above regarding the locomotive equipment apply equally to freight-car equipment. The traffic demands for coal and box cars will greatly exceed the supply, and can be met only in part by the turning out by manufacturers of every possible car of these classes, and by the repair by the railway companies of equipment in use, all of which demands prompt and constructive action similar to that needed in the locomotive department. Freight-car equipment has not been fully maintained during the past year. The inspection requirements in the interchange of cars have been modified and considerably reduced, which will result in defective cars, this in turn cause accidents, all of which has its effect upon the ultimate traffic capacity and efficiency.

The maintenance-of-way department has, with the maintenance-of-equipment department, been subjected to the same abnormal conditions, and this condition is reflected in reduced maintenance of track and struc-

tures. No general constructive policy as to labor has yet been adopted. On many important lines it has been possible to obtain but a small fraction of the necessary labor to maintain adequately the track, bridges, buildings and other structures. The allotments for rail, ties, ballast and timber, so vital for proper maintenance, are not being fulfilled, owing to difficulty in securing labor and material, caused mainly by the higher prices paid by other industries. This is a lamentable condition, and must be met promptly and vigorously if the properties are to be maintained in condition to permit maximum traffic to be handled.

Delay in approving budgets and providing means of carrying out important works has already had its effect, and no time should be lost in adopting a constructive policy in this matter.

The matter of fuel on many railway lines reached a critical stage during the past winter. It was impossible to secure an adequate stock of storage fuel, as in former years, and the grade of fuel supplied was inferior. This caused serious delays to traffic, through engine failures, and in some instances led to suspension of traffic. Railways must have fuel to perform their function properly, and an adequate plan must be made to assure a full supply of good fuel to meet the transportation needs.

Depletion of forces in the rank and file on railways has had a depreciating effect on the efficiency of transportation. The turnover or changes in staff have resulted in the employment in nearly all departments of new men with no previous railway experience. Considerable unrest has prevailed and will continue until the important question of wages, hours of service and working conditions are settled. Discipline cannot be maintained up to the necessary standard under present conditions, and the sooner some constructive and well-defined policy with regard to the men engaged in railway service is adopted the greater will be the results obtained in transportation.

This feeling of unrest among railway employees has extended to some extent to the officials, as in some cases men, after spending a lifetime to reach a position based on merit and faithful service, are suddenly cut off and must necessarily seek other lines of employment. In this manner the railway service is losing a valuable asset which it will require years to recover. The railway service needs these experienced men now more than ever to fill the ranks of the younger men who have been called to the colors.

It has been a tremendous task to change the operations of some 250,000 miles of railway from private to Federal control, and much excellent work has been done, with resultant benefit to the public; but a constructive policy should be outlined and adopted to meet the great emergencies that are now facing the transportation industry, than which there is none more important in the great cause. The salient and outstanding feature which demands immediate and vigorous action should be segregated from the less important, and all energy concentrated on the elements upon which success depends.

Problems of Designing the Reinforced-Concrete Ship

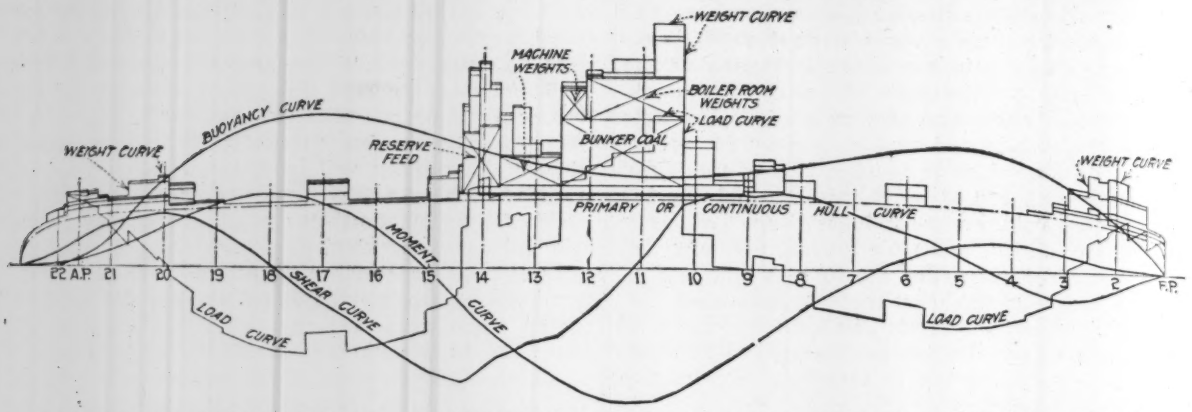
How They Have Been Met By the Emergency Fleet Corporation Told By Messrs. Wig and Hollister In Paper Before American Concrete Institute

CONCRETE ship design has been made the subject of a most thorough investigation by the concrete ship department of the Emergency Fleet Corporation, preparatory to the letting of the contracts for the 42 Government vessels now under way. A résumé of the fundamentals of such design and a statement as to the standards governing the design of the Government ships were given by Rudolph J. Wig, chief engineer, and S. C. Hollister, engineer of design, of the department, in a paper read before the American Concrete Institute in June. The section of the paper devoted to construction problems was abstracted in this journal, July 11, p. 93; the main parts of the design sections are given below. The article may be understood better if read in connection with a study of the details of the 3500-ton ship described in *Engineering News-Record* of July 4, p. 17.

The first consideration that arises in the development of design of a concrete vessel is its form or lines. Many have advanced the belief that concrete ships should be formed with extremely simple lines; with square knuckles and bilges, and with surfaces curved in only one direction. The reason they offer for this is the resulting simplicity in form work. Others believe that this same argument would apply to the bending of plates in a steel vessel, and that the concrete vessel is not alone in presenting this problem. Furthermore, they assert that there is no reason to believe that after a type of form is decided upon the vessels should be more difficult to build on long easy curves than with flat surfaces. The steamship "Faith," which is the first large concrete vessel, has these extremely simplified lines. The vessels at present under construction by the Government have faired lines with surfaces curved in more than one direction. The behavior of vessels of these two types of form will probably give considerable information for future design. It is well known to naval architects that simplified lines are not a hindrance to speed, but rather, if properly designed, may give very favorable results.

The proportions of the concrete vessel are somewhat different from those of the steel vessel. Where the side walls are heavy, the effect is to slow down the period of roll because of the inertia of the sides about a longitudinal axis. This in turn would seem to permit the use of a greater metacentric height than is common in a steel vessel designed for the same service.

The weight of the concrete vessel is in excess of the weight of a steel vessel of equal carrying capacity, and necessitates a careful consideration of the arrangement to gain a maximum strength with a minimum volume of material. It may be that some future designs will develop to a high degree a system of framework and gen-



MOMENT AND SHEAR DIAGRAM OF GOVERNMENT 3500-TON CONCRETE SHIP, UNDER STANDARD SAGGING CONDITIONS AND LIGHT LOAD

eral arrangement which will more nearly suit the nature of the material than the common type of steel arrangements when made up in concrete. Concrete is capable of higher compressive stresses than tensile stresses, and this reason would seem to make desirable an arrangement which employs to the greatest extent the compressive strength of the concrete.

Computations for stability of concrete vessels do not differ from those made for steel vessels. Developments up to the present time have not introduced any new considerations in the determination of the vessel's stable quality.

Vibration and Twisting Will Be Taken Care Of

There are a number of peculiar actions in the life of a ship which have caused considerable discussion among shipbuilders and ship operators in general. One of these is the effect upon concrete of the vibration of the engines. It has been thought by many that the vibration would slowly disintegrate the concrete. Those familiar with concrete construction on land may well realize that this is not in general true, and that there are many fine examples of concrete structures subject to considerable vibration without any apparent deterioration. It has been found, from the concrete vessels at present afloat on both sides of the Atlantic, that the concrete ship exhibits less vibration as a structure than wood or steel vessels.

It is planned to carry out extensive investigations on the completed concrete ship to determine as nearly as possible the points of greatest stress. Pressure recording instruments will be placed at different points on the ship to record the hydrostatic pressure exerted upon the vessel. This work is being carried on under the direction of Prof. F. R. McMillan, formerly of the University of Minnesota. Recording strain gages will likewise be placed at critical points to measure the deformations in the material. Some of these will be placed upon the members of the transverse frames, while others will be placed on the side wall to measure the deformation in the shell reinforcement. Measurements will also be taken upon the longitudinal steel in the deck and bottom. Attempts will be made to measure every possible torsional strain occurring in the vessel. There are several places in the vessel where there is a congestion of stress. One of these points is at the corner of hatch openings. Another point is the gunwale at either end of the shell, forming the side of the bridge erection.

One problem of seaworthiness of the concrete vessel is the resistance it may offer to pounding and panting. The first term is one applied to the action of a boat whose forward or after end has been raised out of the water and then smashes down onto the surface with a tremendous impact. The second term applies more generally to the flexible action of a steel vessel and describes the diaphragm action of the plating as the external hydrostatic pressure alternately increases and decreases. Just what the resistance of the concrete shell will be to such a sea condition remains to be seen. It is only logical to suppose, however, that the concrete shell will not be so apparently flexible as the steel shell and that, therefore, panting will not be apparent. Similarly, it would seem that a considerable reliability may be placed upon the strength of the concrete frame under impact, in the light of our present knowledge of structural action in general.

Machinery Location Important

The speed of a reinforced-concrete ship has thus far been assumed to be the same as a steel ship having the same outer form and dimensions. The only experience which we have at present with the surface friction of a concrete vessel or of concrete in water has been obtained from flow of water through pipes and conduits. It is common to assume that in the cases of pipes and sewers the surface of concrete presents a smoothness equal at least to the surface of steel. It is quite likely that with proper care in the surface of forms in which concrete vessels are cast the outer surface may be materially smoother than the surface of a steel vessel.

The machinery arrangement has an important bearing on the design of a concrete ship. Naval architects are familiar with the fact that very often with the engines aft in a cargo ship the hogging moment is larger than with them amidships. This may not be true with an oil tanker if the oil compartments are grouped amidships to neutralize the hogging effect of the engines aft. It is more desirable to have a larger hogging moment than a sagging moment, because such an arrangement will reduce the likelihood of cracking below the waterline. The location of the machinery, therefore, has a large bearing on the design of the strength of the ship

because of its influence on the disposition of the cargo.

In every phase of the design of the concrete ship, the principle of continuity cannot be overemphasized. The path of stress should be as direct as possible, and there is ample evidence that sudden change of section of the member carrying the stress results in failure of varying magnitude. The transfer of stresses around openings in the deck must require far more attention than would similar ones in the floor of a building. The design of the connection of either end of any deck erection likewise requires the greatest care.

The type of vessel more suitable to concrete would seem to be a vessel which has the greatest possible continuity in its deck line. This statement would offer criticism of the commonly called "three-island type." It would seem likewise to favor the adoption, at least at present, of the flush-deck type as far as possible. The chief difficulty with the three-island type is the provision of longitudinal expansion in the bridge deck and in the sides of the vessel between the bridge and main decks.

Longitudinal Strength First Computed

A section of the original paper is devoted to a description of the standard naval architectural method of determining the longitudinal bending moment and shears under different conditions of loading and wave length. It then continues as follows:

The bending moment which is found as a maximum at a point in the midship section is considered to act over 40% of the middle body instead of acting as the exact form of the bending moment curve for hogging and sagging would indicate. The steel is carried forward fore and aft of the midship section to provide for this moment.

Having now the attacking bending moment and shears, it is necessary to compute the properties of the cross-sections at the points of maximum moment and maximum shear. Properties of the section which are important are the position of the neutral axes, the moments of inertia in hogging and sagging, the arms of the resisting couples commonly known as *jd*. It is common to neglect tension in the concrete in making these computations. The location of the neutral axes may readily be determined by tabular computations and at the same time the moments of inertia about the base line may be determined and later transformed to the neutral axes. In a similar manner the values of *jd* may be determined.

Section modulus may now be computed and the fiber stresses at any point in the cross-section determined from the common formula V/bjd. It is very instructive to construct a curve of shear displacement for the total cross-section of the vessel. Such a curve will point out the fact that the shear in the side walls of a vessel is very nearly constant between decks or between the bilge and the next deck above.

The flexural stresses in the gunwales and in the bilges are greater when the vessel is listed than when it is righted, and must be computed. The difference in stress between the listed and righted positions shows an increase of from 10 to 20% for the listed position over the righted position, depending upon the form of cross-section.

The department requires a concrete having an ultimate strength of 4000 lb. per square inch in 28 days. With this as a basis, the adopted unit stress in outer fiber of 1500 lb. per square inch is 37½% of the ultimate. A bond of 200 lb. per square inch is allowed on reinforcement deformed to provide a positive mechanical bond. The tensile unit stress in steel is 12,000 lb. per square inch in places where the formation of cracks would lead to seepage, and is 16,000 and 20,000 lb. per square inch in places not exposed to the water, the highest value being used in the intermediate transverse bulkheads.

Placing of Longitudinal Steel

There has been considerable discussion concerning the ability of longitudinal steel in the deck and bottom which lies approximately on the center line to develop stress during flexure of the vessel. In ordinary practice the nearest analogy we have to the action of this steel is that action which occurs in the ribbed floors in which the ribs are 30 or more thicknesses of the slab apart. The slab in such a ribbed floor is in compression when there is flexure in the ribs and the unit compression stress is higher immediately over the ribs than midway between the ribs and parallel thereto. The same action occurs in an I-section in flexure when the leg of the outstanding flange is 30 or 40 times its thickness. In both cases, and more frequently in the latter, perhaps, curling results on the transverse section near the end. To what extent this action may be found in a reinforced-concrete vessel has yet to be determined. Undoubtedly, if the stress is smaller near the inboard than near the outboard, the stress outboard must be higher than that originally intended, in order to develop the total tensile resultant necessary to maintain the resisting couple. Now, if it were possible to determine the stress in the deck or in the bottom of the vessel's center line and also the stress in the deck or in the bottom near the outer wall, it would then be possible to compute the longitudinal shear stress between the center line of the vessel and the outer wall. Even though this stress on the center line may be zero, the longitudinal shear in the deck and in the bottom near the side wall would not be as large as it would be in the side wall near the dock and in the bottom, respectively.

There are many difficulties which are met with in the distribution of the longitudinal steel in the cross-section of the vessel. It seems reasonable to suppose that the most effective position for the longitudinal steel would be as near the sides as possible; or, in the case of vessels with longitudinal bulkheads, as near the sides and the bulkheads as possible. This merely groups the steel close to the members which take the shear.

Shear Values Used Higher than Usual

The maximum shears acting upon the vessel occur at approximately the quarter points of its length. Both for hogging and sagging it will be found that at a point near amidships the shear will become zero. As the vessel passes from hogging to sagging it will be found that the shear may not be zero at the center of the length of the ship as given by these two cases, but may be in some instances two-thirds as much as the maximum shear. It would seem consistent practice to

carry the scheme for the shear reinforcement continuous between the quarter points.

Two systems of reinforcements may be employed, one in which the reinforcement runs diagonally and another in which the reinforcement runs vertically and horizontally. There are many practical considerations which require study before the choice may be made between these two systems of reinforcement. These considerations will be pointed out in considerable detail in the discussion to follow concerning types of framing.

The shearing unit stress which is used in the design must, if possible, be much higher than that used in building practice, in order to obtain a vessel of economic weight. Early designs made by the department were based upon the unit shearing stress of 300 lb. per square inch. A later design was raised to 400 lb. per square inch and the department is at present engaged on a design of an oil tanker of 7500 tons dead-weight capacity, using approximately 500 lb. per square inch in shear.

The department has conducted some tests at the Bureau of Standards laboratory at Pittsburgh under the direction of Prof. W. A. Slater of the University of Illinois. Although these tests do not by any means cover the field of ship construction, they do justify the use of the shearing values above mentioned, provided that the proper value be assigned to the unit stress in the steel in a tensile direction. For instance, if when designing with a unit shear stress of 500 lb. per square inch the vertical shear bars are obliged to carry all the shear at 10,000 lb. per square inch in tension, the combination will be worked at a factor of safety of approximately 2.5. From the tests at hand it seems reasonable to limit the tensile stress in vertical bars to 10,000 lb. per square inch. It is possible with these unit stresses to use the formulas proposed by the Joint Committee for the design of members in shear.

The design is usually made to meet the shearing stresses in the sides, and if the shearing reinforcement is carried around the bilge and gunwale into the bottom and the deck, it would be expected that the shearing stresses in the bottom and in the deck were amply provided for. This is the practice at present in use by the department.

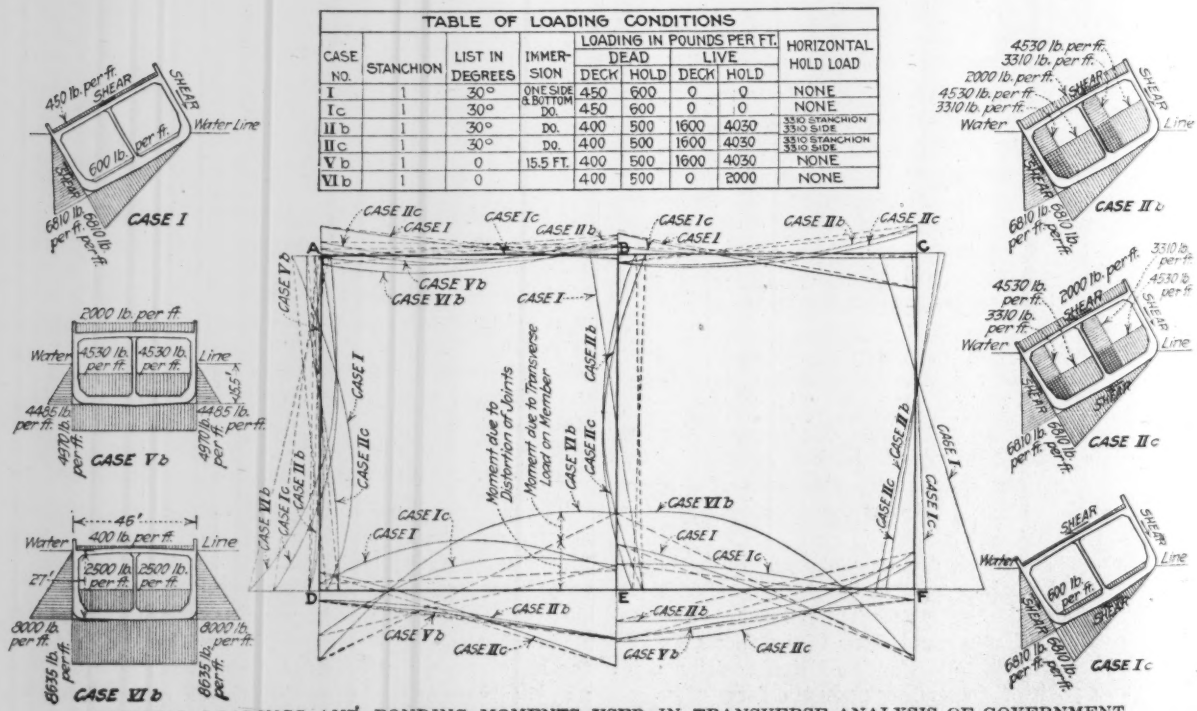
Cracking will occur in the use of shearing values and steel stresses mentioned above if these stresses are developed. These cracks, however, are incipient and are not calculated to admit water even under considerable head. This is being investigated to determine approximately the size of crack above which seepage may be expected. It is believed, however, that such cracks will not interfere with the range of unit stresses mentioned above.

The transverse strength of a vessel is usually supplied in wood and steel by ribs or frames. The same provision for strength has been maintained in the concrete vessel. If the frame type is used the water pressure against the hull is transmitted immediately to closely spaced transverse frames. On the other hand, if the Isherwood system is used, the water pressure against the shell is transferred to widely spaced transverse frames through the action of closely spaced longitudinal stringers. These frames may take various forms to withstand the pressure against the ship, such as an open rectangular frame, an arched frame, a frame with intermediate hold beams or decks and stanchions, and a frame with some form of trussed bracing.

Practice in commercial naval architecture is at present to proportion the sizes of the transverse ribs and other members by data based upon previous experience

TABLE OF LOADING CONDITIONS

CASE NO.	STANCHION	LIST IN DEGREES	IMMERSION	LOADING IN POUNDS PER FT. DEAD DECK	DEAD HOLD	LIVE DECK	LIVE HOLD	HORIZONTAL HOLD LOAD
I	1	30°	ONE SIDE & BOTTOM	450	600	0	0	NONE
Ic	1	30°	DO.	450	600	0	0	NONE
II b	1	30°	DO.	400	500	1600	4030	3310 STANCHION 3310 SIDE
II c	1	30°	DO.	400	500	1600	4030	3310 STANCHION 3310 SIDE
V b	1	0	15.5 FT.	400	500	1600	4030	NONE
VI b	1	0		400	500	0	2000	NONE



CRITICAL LOADINGS AND BONDING MOMENTS USED IN TRANSVERSE ANALYSIS OF GOVERNMENT 3500-TON CONCRETE SHIP

with various weights of frames. The rule books of the Registry Societies, for instance, often form the basis of a design of a steel or wood merchant ship, the sizes of frame members being taken directly from the tables therein.

Two methods are followed at present in the design of frames for concrete ships. The first relies upon the rule book to determine the size of a steel frame for a vessel of similar dimensions, and then duplicates this steel frame in concrete. The second method assumes possible exterior water pressures or interior cargo pressure, or combinations of both, and analyzes the frame according to some phase of the elastic theory. This insures the determination of the bending moments and shears developed under the loads applied which may be cared for by properly designing the members to resist them. If the transverse frame is formed of curved members for the most part, it is analyzed by some one of the various arch theories. If the members, however, are arranged in some form of polygon, the method of slope deflections may be found to give a ready solution. An ingenious treatment of slope deflections was independently developed by G. A. Maney and published by him in "Bulletin No. 1, Engineering Studies, University of Minnesota," in March, 1915. As an approximate check on results comparison may be made with steel vessels of similar size, the seaworthiness of which is known.

There are many advantages and disadvantages in each of the types of interior framing at present proposed or in use. The Isherwood and the frame types are the most common and have received the most consideration. The Isherwood system provided for its local stresses in the slab by rods running around the ship's girth and hence normal to the section of longitudinal stress. The ribs running between the wider spaced frames, however, are subjected to bending, which bending is in the section of the longitudinal stress and therefore must be considered in making the combination for maximum stress. The frame type, on the other hand, reinforces against local stresses in the slab by means of rods running longitudinally in the shell. It may be readily seen that this fact reduces the efficiency of the longitudinal steel because of its effect in lowering the component tension which is available for resisting longitudinal flexure. It is asserted by some that the frame type proves an inferior system when hogging or sagging occurs, because of the absence of longitudinals between frames to assist in carrying the compression.

Torsional Strength Important

Torsional strains in the vessel are the most difficult to compute. The stresses set up are essentially shearing stresses which must be carried by the shell of the ship. Since the common form of vessel is wider than it is deep, the maximum torsional shear is to be found in the deck and bottom, at the center line of the vessel. Because of the openings necessary in the deck the torsion produces the most severe results near the midship section in the neighborhood of the hatch openings, particularly at their corners. The torsional moment will not exceed a fourth of the loaded displacement of the vessel multiplied by its maximum righting arm. This will be somewhat excessive for the larger vessels now under design. The maximum torsional stress will not occur simultaneously with the maximum longitudinal stresses, because the vessel must be in a quartering seaway, with the wave period shorter than the vessel's length.

Details of equipment are no different from similar details for vessels constructed of other material, but the method of attachment employed with each separate fitting is very often far different from the method of attachment employed in steel or wood ships. Special care must be exercised in placing any casting which penetrates the outer shell or any casting which passes through any water-tight bulkhead. Many of the attachments on the deck and in the interior of the vessel may be made by molding the anchor bars permanently in concrete at the time of pouring. Any fitting, however, which is apt to require replacement should be so attached as to be removable for repair or renewal. The most difficult attachment of all is the cast-steel stern frame of the vessel. This frame supports the rudder and the after end of the stern tube, so it is required to take the lateral thrust of the rudder and the vibration of the propeller. The shoe of the stern frame which connects the lower end of the rudder stock at the point of juncture of the keel with the lower end of the stern post is so designed as to be able to withstand the riding of the vessel on a bar or other obstruction. Particular attention is paid to the ease with which the stern frame may be repaired if once broken. It is probable that a large percentage of breakage of stern frames on concrete vessels will occur in the shoe or in the lower end of the rudder stock. This portion of the stern frame should be so scarfed as to be removable for repairs. The frame may be designed so that the whole stern frame may be detached from the hull. This may be accomplished by putting on cheek plates which extend from either side of the stern frame casting back along the side of the skag or surface of the ship at the stern. The reinforcing rods may be rigidly attached in a number of ways to the inner face of these plates. In some instances these plates may be cast as flanges from the stern frame and the same method of attachment of the reinforcing bars effected.

Water-Works Material and Labor Go Up

Commenting on the fact that water rates at Los Angeles were reduced during 1917, the Department of Public Service of that city, in its July "Bulletin," points out that labor and materials have gone up in price in the past three years and that it has been necessary to make "serious retrenchments" in improvements, extensions and reconstruction. Increases in the cost of materials and of labor in 1917-18 over normal prices paid in 1914-15 are thus summarized in the bulletin: Cast-iron pipe, 124%; galvanized pipe, 80 to 149%; pig lead, 68%; steel pipe, 214%; fuel oil, 149%; brass goods, 102 to 116%; cement, 50%; well casing, 393%. Increases on other materials are about parallel to the foregoing. Unskilled labor has increased one-third in cost, and skilled labor has advanced 50%, without the department being able to compete with war industries, so that its very valuable construction engineers, foremen and mechanics are leaving city employ for shipbuilding and other trades.

St. Louis Checks Public Works But Pushes Post-War Plans

Big Sewer and Paving Programs Heavily Cut—Local Materials Go Up—Plans for All Projects Being Continued

By W. W. Horner
Chief of Design and Construction, Division of Sewers and Paving, Board of Public Service, St. Louis, Mo.

EARLY in 1918, the Board of Public Service, St. Louis, reviewed all contemplated improvement work in the hands of the Division of Sewers and Paving and arranged a tentative program for the year. Under this program it was proposed to defer all large sewer work, amounting to about $15,000,000, for which it had originally been proposed to issue bonds. This work was made up of the River des Pères main drainage project and storm-water relief sewers for a part of the older section of the city. The only sewer work proposed consisted of about $200,000 worth of small extensions. Bids were recently received for a portion of this work.

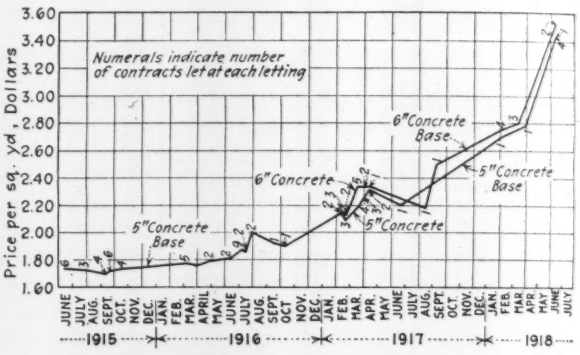
One contract originally estimated at $65,000 was awarded at $95,000, as it was considered to be essential to the operation of certain necessary industries. Another contract for sewers in a residence section, for which the bids were practically equal to the city's estimate, was rejected on the protest of property holders that the money was necessary for expenditures in other directions. This plea was accepted by the board, as the district was partly served by private sewers. Other bids exceeded the estimates by 10 to 15 per cent.

At the beginning of the year the street and alley paving work under procedure amounted to 152 contracts, estimated at $1,750,000. Of this amount it was decided to defer about half, some contracts for a period of one year, others to the end of the war and still others to await lower prices. Of the remaining amount, the city has awarded 53 contracts, amounting to about $520,000. All of this amount has, however, been let on a rising market and probably at an average of 30% above the estimates in the preliminary program.

As an example of the rate of increase, the curve for brick paving is given herewith. The city was prepared to proceed with work at prices of $2.75 or $3 but it was felt that the June, 1918, bid of $3.50 made it necessary to reconsider the whole situation. A canvass was made of the sentiment of property holders and a careful analysis of the value of the paving to the city at large. As a result, six proposals of the June letting amounting to $156,000 were rejected and these items laid over indefinitely.

In rejecting these projects the board was of the opinion that the bids were probably reasonable under the circumstances and that the work could not be obtained at a lower price for a number of years, but reached its adverse decision on the ground that the high prices indicated that the labor and material were seriously needed elsewhere, and also that it was inadvisable to force the citizens to spend money for this purpose when so many demands were being made on account of matters related to the war.

It appears, moreover, that if a decision to defer work had not been reached in this way, the same effect would have resulted from the curtailment of materials and the shortage of labor. This is all the more notable because the materials entering into brick pavement in St. Louis are entirely local in their origin. Sand is dredged on the city river front. Stone comes from local quarries. There are two cement mills practically within the city limits, and the largest paving brick yards in this district are quite centrally located in St. Louis. The local brick companies have found it necessary to advance paving brick from 88c. per square yard in 1914 to $1 at the end of 1917, $1.15 this spring and $1.30 at the present time. This advance in brick is due to the increases in the price of coal and labor, the former increase being due in part to higher freight charges. On account of high labor cost both sand and stone have increased in price from 20% to 40%. The actual labor used by the contractor has increased from $2.50 for a 10-hour



BRICK PAVEMENT PRICES GOING UP AT ST. LOUIS
Prices are averages of low bids for number of jobs indicated at each letting and include concrete base

day to $3 for nine hours and in some cases 35c. per hour. Labor used on sewer work has gone much higher, in some cases to from 40 to 45 cents.

Brick manufacturers may soon find it necessary to close their plants on account of having used up the amount of coal allowed by the fuel administration. Already a large sewer pipe manufacturer has announced that he will have to close about Aug. 15.

Sheet asphalt materials are also of local origin, except the asphalt itself, but several contracts are at present held up, awaiting Government license to purchase the asphalt.

Increased freight rates and the uncertainty regarding the final rulings under the new rates make it almost impossible at present to obtain quotations on any material where railroad transportation is involved.

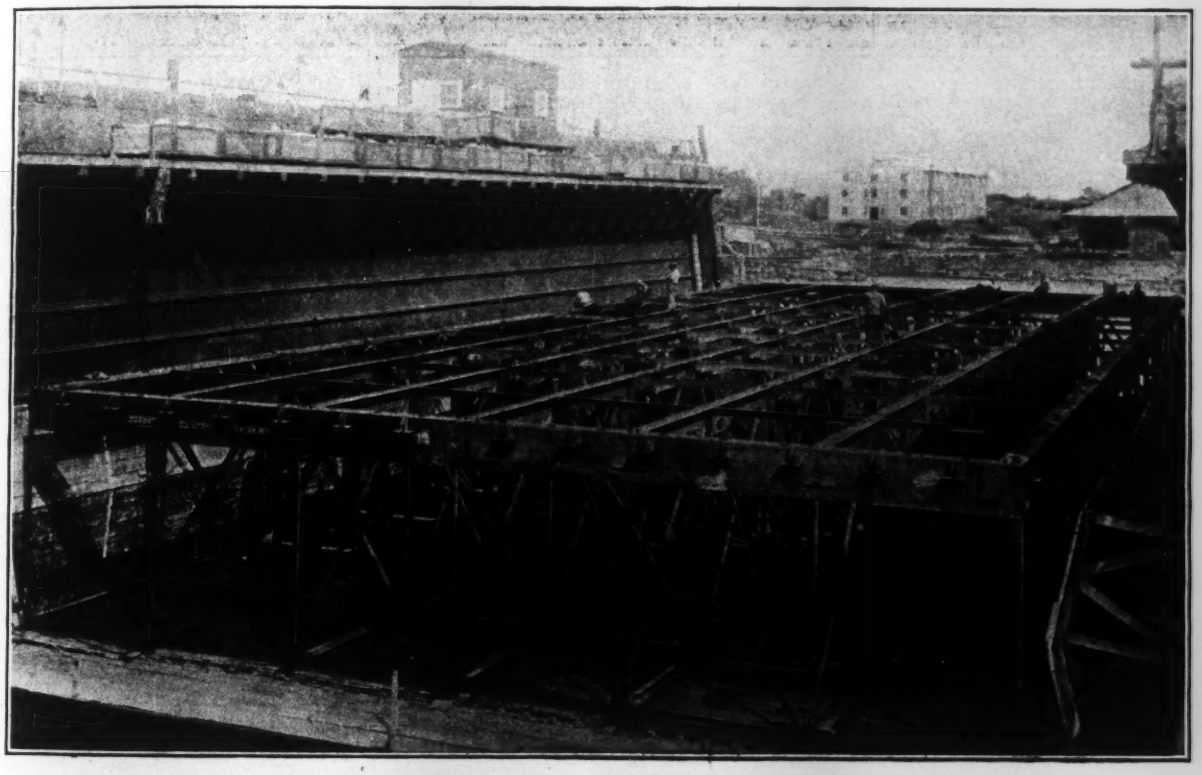
As a result of this unsettled condition, St. Louis will probably defer a considerably greater portion of its improvement work than was originally contemplated. If the transportation and labor situation shows a tendency to become very stable, probably a number of projects will be offered for bids in August, but decision on most will be deferred at least until next season.

In the meantime the city is going ahead with the preliminary work for all its contemplated projects. It is securing the passage of ordinances, preparing plans and specifications and is laying aside finished results until the arrival of the opportune time. As a result, the city now has partly completed the necessary procedure for $12,000,000 to $15,000,000 worth of sewers and pavements to be brought forward after the war.

Construction of the Pearl Harbor Drydock Completed

Novel Method of Placing Unit Sections of Concrete Base and Walls from Floating Dry Dock and Building Upper Works in Movable Cofferdams Put Through in Two Years

PEARL HARBOR dry dock in Honolulu harbor, Hawaii, constructed by the radically new method of floating into place massive concrete sections weighing close to 8000 tons apiece, is rapidly approaching completion. All 16 of these sections are in place and have been connected up by tremie-placed concrete joints up to high-water line. There remain only the completion of the installation of the mechanical equipment, the placing of the steel caisson gates and the continuation of the sectional joints from the high-water line to the top of the dry dock. The first service test of the structure is expected to take place late in July.



STRUCTURAL STEEL REINFORCING WAS ASSEMBLED ON FLOOR OF FLOATING DOCK

The Pearl Harbor dry dock, being built by the United States Navy Department, is 1029 ft. long out to out, 152 ft. wide out to out and has a clear water basin 1010 ft. long and 101 ft. wide at the bottom clearance. It is 43½ ft. deep from top of coping to floor. The dock has a long history. It was originally planned about 10 years ago, and construction started soon thereafter. On Feb. 17, 1913, a blowout occurred in one of the cofferdams and stopped all construction work on the dock. The Bureau of Yards and Docks of the Navy Department early in 1915 adopted a new plan for the construction, and a supplemental agreement with the original contractor, the San Francisco Bridge Co., of San Francisco, was entered into. Construction work was soon started. An extensive report on the dry dock, including the history of the early construction and a full description of the investigation preceding the adoption of the new design appeared in the *Transactions* of the American Society of Civil Engineers, Vol. 80, 1916, p. 223, in a paper entitled "Pearl Harbor Dry Dock," by Civil Engineer H. R. Stanford, U. S. N., then chief of the Bureau of Yards and Docks of the Navy Department. Current reports on the new design also appeared in *Engineering News* of Jan. 14, 1915, p. 87, and *Engineering Record* of Jan. 16, 1915, p. 82.

The revised scheme of construction involved the dividing of the 1000-ft. concrete structure into 16 transverse sections, each 60 ft. long and the full width of the dock, the building of a portion of these sections as precast units on a floating dry dock, the sinking of these units onto a prepared and piled bottom, the continuation of the construction of the sections—that is, the side walls and the upper part of the base—inside a cofferdam made up of a floating tank movable from section to section, and the final joining together of the 10 separate sections partially by tremie-placed concrete.

Each section was built on a floating dry dock 160 ft.

DOUBLE BOX STEEL COFFERDAM WAS USED TO CONCRETE EACH SECTION IN TURN, BEING DETACHED AFTER SIDE WALLS OF DRY DOCK WERE COMPLETED

long and 100 ft. wide, with lifting capacity of 3500 tons. The actual weight of the sections handled was more than 7000 tons, but their load on the floating dry dock was reduced by flotation. Before the floating dock was constructed it was found that it could as well be made to conform to the requirements of the Inter-Island Steam Navigation Co., at Honolulu, and it was accordingly designed with that end in view. It was sold to the company after the completion of the Government work. The floating dry dock was designed by William T. Donnelly, of New York. It consisted of five wooden pontoon sections and continuous steel sides. Each section was served by two 10-in. centrifugal pumps operated by a 150-hp. motor on each dock wing.

The operations in constructing a concrete section in the floating dry dock began with the placing of the bottom forms, which were laid directly on the deck of the floating dock. These forms were made in sections, and to facilitate their recovery so they could be used over again, they were fastened together with wire ropes. Heavy reinforcement of structural steel was placed in the bottom of each concrete section in the shape of heavily crossbraced longitudinal trusses. These trusses have a depth of 16 ft., the thickness of the dock bottom, and are placed on 12-ft. centers with 12-ft. panel spacing. All four sides of the framework terminate on top in a heavy structural shape to which lugs were attached to receive the anchor bolts used to connect the sections to the steel tank cofferdam. About 120 tons of structural steel were used as reinforcing in each section.

HUGE CRANE PART OF FLOATING EQUIPMENT

All of the forms used were of wood. The forms for the sides around the structural steel framework were attached to the sides of the floating dry dock and so hinged that they could be swung back clear of the concrete. With steelwork and forms in place, concrete was poured over the entire area of the section to a depth of about 8 ft. Around the sides and end of the sections the concrete was brought up to the full depth of 16 ft., in order to form in conjunction with the tank a floating caisson.

After this first stage of the concrete pouring had been completed, the floating dock was submerged, the steel tank floated in over the concrete section, brought accurately into position, and a few of the anchor bolts were made fast by divers. The floating dock was then raised enough to bring the joints between the concrete section and the tank above water level. This could be done without exceeding the 3500-ton capacity of the dock. All of the remaining anchor bolts were then placed. To secure a tight joint, strips of canvas were previously laid on the exposed steel shapes bordering the concrete section, and after the anchor bolts had been tightened a continuous row of wedges was driven along the joint on the inside. Leakage was thus practically eliminated.

The next operation was to submerge the dry dock fully so that the steel tank, together with the attached portion of a concrete section, could be floated clear. The steel tank with the concrete attached, forming a floating caisson, was then towed into position and carefully sunk in place by admitting water to the tank.

Previous to this the excavation of the site was made entirely by dredges—dipper, clamshell and suction dredges all being used. The formation of the underlying material necessitated a pile foundation, and about 12,000 piles were driven and cut off about 1 ft. below the finished grade desired. The site had been excavated

with great care to a uniform grade, and after the piles were driven a shallow layer of crushed rock was placed on the bottom and swept to grade by dragging a heavy steel girder back and forth.

In placing this finished layer of crushed rock, special precautions were taken to keep down to a minimum the amount of leveling that would be required. Timber framework was used both for taking soundings and insuring the accurate placing of the rock. This framework was 12 ft. wide and extended entirely across the site. Cross timbers divided it into a succession of openings 12 ft. square. From each corner of these squares soundings were taken and the amount of rock necessary to bring the foundation up to grade was then dumped in that square. After this method had been applied for the portion of the site to be occupied by a section it remained only to scrape off the tops of a series of small pyramids. After this, inspection by divers showed the foundation to have a uniform level grade.

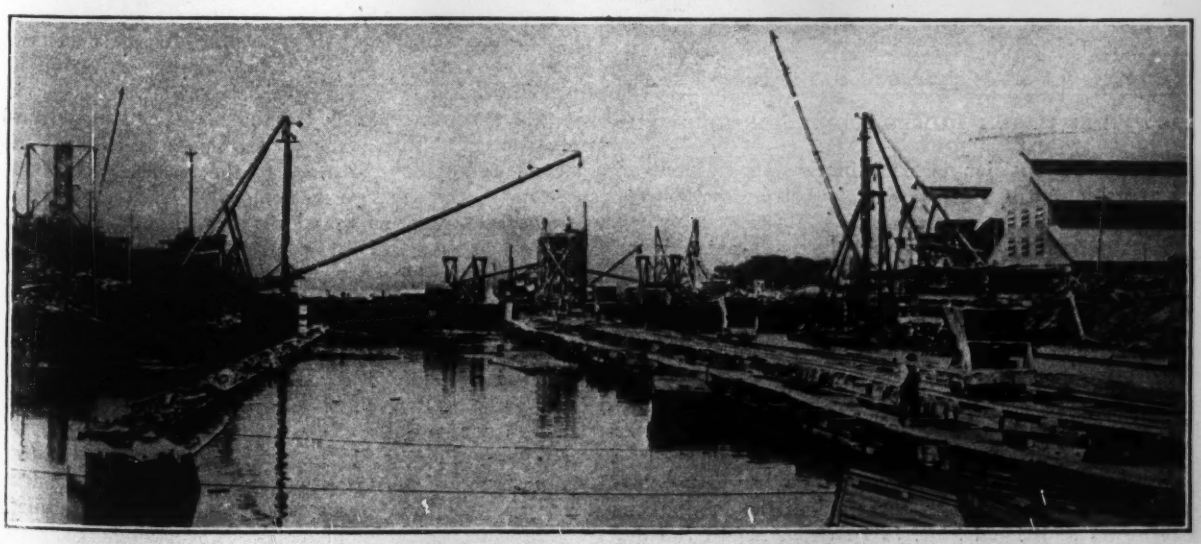
The steel tank served the double purpose of affording, in conjunction with the concrete section, the necessary buoyancy, and providing cofferdams in which the walls and floors of the sections could be built. It was 152 ft. long, 60 ft. wide and about 45 ft. deep. The central portion, 104 ft. long, consisted of a steel tank. Attached to each end of this tank was a steel inclosure 24 x 60 ft. in plan, without bottom, which was used as a cofferdam. The tank itself had a bottom supported on a structural steel framework 6 ft. above the finished floor of the dock, so that there was at all times a 6-ft. clearance between the bottom of the tank and the top of the concrete section. Thus, after a tight joint between the steel tank and the concrete section was made, the open spaces could be pumped out and the tank with the concrete section floated into place, sunk and held in place by water admitted to the tank. The remainder of the concrete—that is, the side walls and the upper 8 ft. of the bottom—could then be placed entirely in the dry.

After the concrete work had been finished on a section in place, the steel tank was removed by releasing

SIDEWALLS BUILT WITHIN STEEL TANK

the anchor bolts, letting the water in the tank run into the cofferdam and pumping out the rest of the water so that the tank would rise free of the concrete section. As the tops of the concrete walls extended above water level, gates were provided at bottoms of the inboard cofferdam walls so that the floating tank could be towed off without interference. For pumping out the central section of the steel tank, 15-in. centrifugal pumps were used, belted to 125-hp. motors. Pumps and motors were carried in an elevator cage which could be raised and lowered to suit the level of the water.

To resist the water pressure against the cofferdam walls after the tank had been sunk it was necessary to provide struts extending from wall to wall. For the greater portion of their length these struts were made of reinforced concrete. Thus, as the concrete walls were built up to the struts they were embedded and the work proceeded without the interruption that would have been occasioned by the necessity of removing tim-

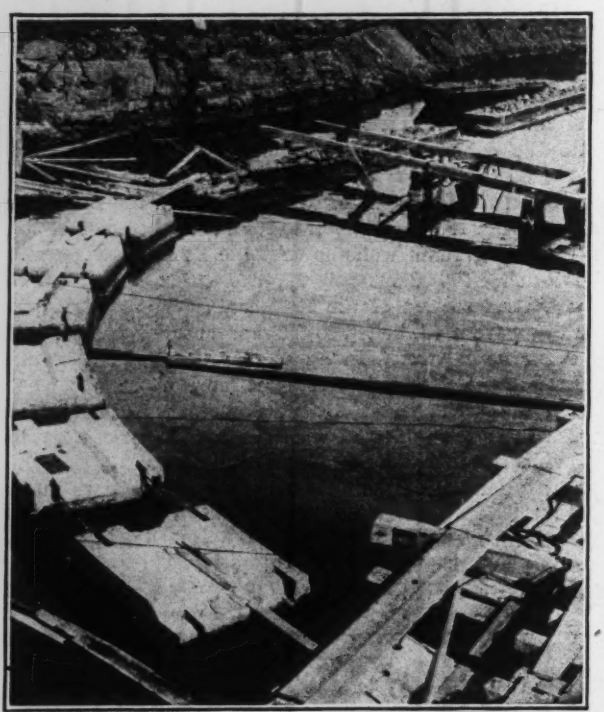


CONCRETE WAS CARRIED TO SECTIONS AFTER BEING PLACED ON FLOATING BRIDGE DOWN CENTER OF DOCK

ber struts. The ends of the reinforced-concrete struts were made of timber, and contact with the side walls was through wedge-shaped shoes which could easily be tapped out when removal became necessary.

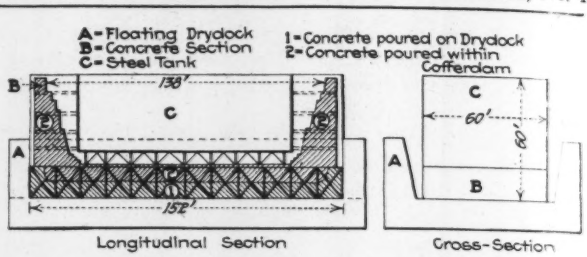
While concrete was being placed in the cofferdams the structural steel and concrete bottom of another section was being built up in the floating dry dock. When the steel tank was released it went at once to the floating dry dock to be attached to the next section. For the most part, a complete cycle of operations on a section was finished in from 30 to 40 days. The first section was sunk on July 7, 1916, and the last one on Feb. 13, 1918.

The shore end of the dry dock is circular in plan and is formed by 14 concrete blocks cast on shore, each weighing about 145 tons. These blocks are about 35 ft. high and of varying widths at the base. All these blocks were set on concrete, placed inside the floating cofferdam and provided with dowels for accurately determining the exact position of each block. On account of the great height of these blocks, the bottom section had to be leveled with great accuracy and its surface floated to a true level, in order to insure true alignment. The blocks were handled bodily by a large floating gantry crane owned by the United States Navy.



MONOLITHIC 145-TON BLOCKS FORMED INSHORE END

A space of 4 ft. was left between adjacent sections of the dock as they were put in place. On the bottom this space was later divided up into 12-ft. lengths by cross forms, or bulkheads, in which concrete was deposited by tremies. In the tremie work great care was used to keep the end of the concrete pipe submerged in concrete, to prevent washing. Concrete to a thickness of about 8 ft. was so deposited in the joints, thus leaving an additional 8 ft. to be deposited in the dry after the dry dock is pumped out. In the side walls



SECTIONS BUILT SUCCESSIVELY IN FLOATING DOCK

the joints were filled in their entirety, tight-fitting cofferdam shields being used for this purpose. These were fastened securely into place with hose gaskets, so the space could be pumped out and the joint concreted in the dry.

The steel caisson, or gate, for the entrance to the dock was furnished by the Government and is now at Pearl Harbor. It is expected this will be put in place about Aug. 1, after which time the dry dock will be pumped out for the first time. The upper portion of the joints in the bottom between sections will then be concreted, and the final layer of pavement over the entire floor of the dry dock will be placed in the dry. It was necessary to leave this until the last so that bilgeways and trusses could be accurately located at exact grade and alignment.

The contractor opened quarries about 12 miles from the site, where most of the materials for concrete were obtained. As no sand suitable for concrete is found in the islands, lava rock had to be crushed to obtain a substitute. A mixture of two parts of this ground rock and one part coral sand was used in place of sand for all concrete poured in the dry. This combination showed satisfactory tensile strength. For all concrete deposited through tremies, sand brought from Puget Sound was used.

Two concrete mixing plants, each equipped with a 2-cu.yd. mixer, were established. One was at the floating dry dock, for supplying concrete to the work at that point, and the other was at the shore end of the site, whence the mix could be supplied on a track over floating pontoons to the successive sections as their walls were built up in place. From cars on this track, buckets were picked up by traveling derrick on either side of the site and dumped into chutes delivering in the cofferdams. Two-cubic-yard steel cars were operated on the floating track by means of a cable from the mixer plant. This made a flexible arrangement and permitted of ready extension of the track as additional sections of the dock were completed. The total amount of concrete used in the dock is about 140,000 cubic yards.

The pump well was constructed as a separate concrete structure built upon the floating dry dock in the form of a reinforced-concrete box with buoyancy enough to float. It was removed from the floating dry dock and the sides were built up while it was floating. This pump well is about 96 ft. long, 40 ft. wide, and the full depth of the dock. It will be sunk into position near the gate to the dock and connected to the main structure by concrete deposited through tremies.

At the inception of the work the contractor installed a steam-electric power plant operating two 250-kw. generators. This was shut down when the Government

Navy Yard plant was put in operation and was found a more economical source of energy. All contractors' equipment and machinery was motor-driven wherever possible. This included a rock crushing plant, a sawmill, a planing mill, a machine shop, pumps, concrete mixers, saws for cutting piles under water, etc. Derricks and pile drivers were operated by donkey engines using fuel oil. The labor problem was a serious one, as there was a scarcity of skilled labor in the islands. Most of the mechanics and enginemen had to be sent out from the Pacific coast. The common labor consisted largely of Japanese and Hawaiians. The latter were found to learn quickly and developed into good derrick engineers, piledriver men, riveters and divers.

The work has been carried out under the general supervision of Admiral C. W. Parks, now chief of the Bureau of Yards and Docks, and until recently stationed at Pearl Harbor. The contract for the work was held by the San Francisco Bridge Co., S. G. Hindes, president, and W. F. Dillingham, manager for the Hawaiian Islands. Construction was entirely in charge of Francis B. Smith, chief engineer for the contractors.

Some Things Engineers Serving as City Managers May Be Expected to Meet

Notes Based on Two Years' Experience at San José—Accounting, Civil Service, Legal, Health, Fire, Police, Engineering and Political Problems Solved

By Thomas H. Reed
City Manager, San José, Cal.

SO MANY engineers are in these days being called upon to act as city managers that a brief sketch of the things that they may expect to meet in the office should prove interesting to the readers of *Engineering News-Record*. It should be borne in mind that the city manager is primarily an executive officer and that the first quality which he must possess is executive ability. It should be further remembered that the management of a public enterprise such as a city government calls for something more than mere executive ability. It is necessary to manage not only the city government but, in a certain sense, to manage the people of the city as well. It is absolutely essential that there should be public approval of a city administration.

First Task of City Manager Under New Charter

The first task which confronts one who, as did the author, becomes the first city manager under a new charter, is that of a very thorough and complete reorganization of the city administration. San José had been governed, prior to July 1, 1916, like hundreds of other American cities, in a somewhat haphazard manner. There was a variety of independent officials, boards and commissions, with no one supreme authority. There was no habit of looking to a single head for direction. This habit had to be created, and it was created with some difficulty. There were officials in charge of certain departments, who, belonging to the old political school, took their lead from forces outside the city government. It was necessary to remove some of them because they could not realize there was under the new plan but one head. There formerly was considerable friction between departments. Each was jealous of another, and it took time and effort to get them all working together harmoniously under a common leadership. With two or three exceptions, this was accomplished without changing the personnel of the departments.

Next in importance to engendering this habit of united effort the most necessary improvement, it was found, was a modern accounting system. San José, like many other cities, had a system which kept account of the inflow and outflow of cash, but nothing else. It gave no administrative information. When the city manager plan was inaugurated it was impossible to tell in just what condition the previous administration had left the finances of the city. This situation was immediately corrected by the installation of a first-rate accounting system which brings to the attention of the city manager all the information usually offered to the manager of a large private corporation. The importance of this cannot be overestimated. When any organization grows beyond the point where its transactions can be carried in the head of some individual an adequate accounting system becomes immediately necessary. It is the eyes and ears of the manager. It keeps him in touch as nothing else can do with what is occurring in the various departments.

Putting Employees on Merit Basis

Next in importance was the installation of a method of placing the procuring of municipal employees upon a merit basis. This had been provided for by the new charter, and as soon as that document went into effect the civil service commission was appointed and proceeded to adopt rules and to conduct examinations with a view to eliminating politics from appointments. In many instances examinations were held for positions which, under the charter, were technically outside the classified service. Such a system of merit appointments had a tendency to improve the quality of municipal employees and to remove the corrupt influence of politics. From the manager's point of view, perhaps, its greatest advantage is the happy release it gives him from the pressure of office seekers and office seekers' friends. A manager cannot help thinking at times that he could by the use of his own untrammeled judgment make better selections for office than can be made through the artificial medium of examination. But on

the whole his administration is better off for having a more or less automatic method by which employees can be selected.

Importance of City Attorney

Another matter of great general importance to the successful reorganization of a city government is the prompt and cordial coöperation of a competent city attorney. This is true even where, as in San José, the city manager was himself trained as a lawyer. It would certainly be a matter of very great importance where the city manager was an engineer by profession. Next to the manager the city attorney is the most important general officer of the government. Upon his wisdom and helpful spirit depends to a large extent the success of every venture.

Having taken care of these concerns of the whole administration, the next step is the internal reorganization of the several departments. In San José under the old system the city money was kept partly in an unsafe vault in the city hall and partly in safe deposit boxes in one of the banks. It drew no interest. A fund of $49,000 lay in the vault in actual gold for 16 years without one penny of return. One of the first steps of the new administration was to deposit the public funds in a bank which agreed to pay 2.52% interest on average daily balances. As part of the transaction, the bank furnished gratuitously the services of its cashier as treasurer. Altogether, a permanent saving of $5000 a year to the city was accomplished in this manner.

Full-Time Health Officer Engaged

The health department had been conducted as the health departments of small cities frequently are, by a physician who received $100 a month for a part of his time. The amount of assistance received by him was inadequate, and the work of the department was necessarily incomplete. The new administration recognized at once the necessity of improvement in this direction. The department was placed under the nominal headship of one of the leading physicians of the city, and an assistant health officer of high professional training was employed to give all his time to the work. A diagnostic laboratory was added, and there has been a pronounced improvement in public health conditions.

The fire department illustrates what can be done under the city manager form of government without change of personnel. The fire chief was a man of excellent capacity, who had been obliged, however, to devote a large part of his time to the kind of politics necessary to retain his office. He was told that under the new régime all that would be required of him was to run his department properly and that if his did so he would be sustained. He has loyally and steadfastly followed out this suggestion. Under the old system his control of his men was inadequate, because they could successfully appeal over his head to the members of the board of fire commissioners. Under the new system his discipline has been greatly improved, because he is an unquestioned authority in his department. The improvement in the efficiency of the fire department is variously estimated at fifty to one hundred per cent.

The chief of police in office at the time the new form of government went into effect was one of those officers who failed to give adherence to the new order. It was found necessary to remove him and to put in his place a man who was prepared to devote himself exclusively to bringing his department up to the modern standard of efficiency. Perhaps the most important single change in this department was the introduction of an adequate system of finger-print identification, the absence of which had long been a source of criticism on the part of up-to-date police officers in neighboring cities.

City Engineer Made Important Executive

Under the old system the engineering department had been entirely separate from the street department. The new charter provided for a department of public works of which the city engineer was to be the head. Experience has justified this arrangement. Under the old system the engineer received $150 a month and had nothing to do except prepare plans and specifications and supervise construction work. Under the new system he became a very important executive officer in charge of the department through which passed about one-third of the money expended by the city. The salary of the city engineer was fixed at $275 a month plus an allowance for transportation. A very competent young man of both engineering and executive experience was obtained for the place. Under his management the work of the public works department was done more cheaply and at the same time better than ever before.

It is not to be supposed that these changes were made without arousing opposition. The removal of the chief of police brought down upon the manager the wrath of the leading newspaper and of numerous politicians. The change in the office of the city engineer aroused great criticism. Many persons affect to see in the new arrangement a too great allowance for overhead. They do not realize the change in the nature of the department. The $3000 expended for the accounting system has been regarded by some as a reckless extravagance, and there even have been persons who have pointed the finger of ridicule at the system of identification employed in the police department. Similar criticism awaits the conduct of the city manager in any city, and can be avoided only by refusal to meet the plain obligations of his position. No man of courage or vision will be turned aside from his purpose by reason of the fact that opposition of the character described is to be his portion. It has been demonstrated in San José that the people are inclined to ignore the council, which is supposedly responsible to them for the acts of the manager, and to direct their attention straight to the manager himself.

City Manager Plan Works Admirably

There can be no doubt that the city manager plan of government works, and works admirably. The experience of San José is sufficient proof that even under somewhat difficult circumstances it will produce administrative and financial results fully up to the expectations of its advocates. The great difficulty with the city manager plan of government is the difficulty which underlies all democratic governments; namely, the attitude

of the people toward their own institutions and representatives.

A successful manager should be a man capable of leading public opinion. This does not necessarily mean that he should be a speech maker or a brilliant writer, but a man with some idea of what the public wants and of sufficient pliability of temperament to adjust himself to the prejudices of the people. I have known of men who have won distinct success as managers of great corporations, but who, on taking up political tasks such as that of mayor of a city, have met with failure—not so much because their plans were bad as because their methods were dictatorial. A manager must possess tact as well as firmness, and he must be prepared to handle men—in the widest sense of the term—if he is to succeed. There is no absolute certainty that any city administration will please the public. The present administration in San José, for example, has earned the displeasure of that large section of the public most nearly controlled by the old-time politicians. This is one of the difficulties—grave misfortunes, indeed—of the city manager form of government and of the lot of the city manager, but it is incident to democracy itself.

Algae Growths Increase Value of *n* in Kutter's Formula

Studies Made in 1912-16 in Tieton Irrigation Canal Lined with Reinforced-Concrete Blocks Indicate that Growths Raise *n* from 0.012 to 0.014

By Paul Taylor
Assistant Engineer, United States Reclamation Service, North Yakima, Washington.

ALGAE growths have a marked effect upon the capacity of the concrete-lined main canal of the Tieton unit of the Yakima Project of the United States Reclamation Service in the State of Washington. Observations detailed below indicated that for this canal a fair value of *n* in Kutter's formula is 0.014. Data on the effect of structural and other local conditions were also obtained.

The design of this canal is unique. The structure is approximately 12 miles long, about 17½% of which is tunnels. The greater part is lined with standard reinforced-concrete shapes, 2 ft. long, with a minimum thickness of 4 in. The open section (see view) has a clear depth of 5 ft. 10 in. and an inside radius of 4 ft. 1 13/16 in., the shell being held in shape by a cross arm 4 in. wide and varying in thickness from 4 in. at its union with the shell to 6 in. in the center.

Of the six tunnels, two are short and only about 60 ft. apart, and are lined with standard open-canal shapes. One is lined with monolithic concrete, the cross-section being of the horseshoe type. The roof is unlined throughout the greater part of its length. Where the roof is lined the clear distance is 6 ft. between the base of the invert and the roof, while for the unlined portion the distance is 5 ft. from the invert base to the plane of the side-wall top. The remaining tunnels are alike in cross-section, a standard, circular reinforced-concrete ring being used, the inside radius being 3 ft. ⅝ inch.

To protect the canal during the irrigation season five wasteways have been inserted for handling the water, as the canal is tortuous in alignment and skirts numerous steep, rocky bluffs from which large boulders sometimes fall, temporarily blocking the structure. These wasteways all possess sumps in the canal; the least of these is 9¾ ft. long and 8½ ft. deeper than the canal bottom.

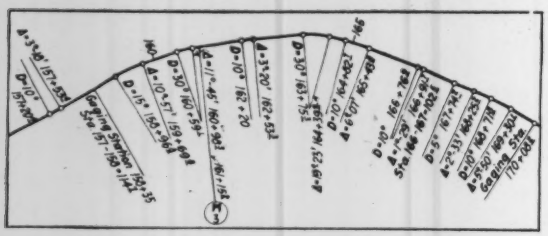
As designed, the canal was to carry 300 sec.-ft., when foul and 326 when clean. The value of 0.012 was assumed for Kutter's *n*, and the depth of water was to be 5¼ ft., with a freeboard of 7 in. when the slope was 0.00165. From 1912 to 1916, inclusive, data were gathered for the purpose of determining the actual value of Kutter's *n* in a stretch of the open section, and in 1915 and 1916 further data were secured to determine the application of the coefficient, as found in this section, to the canal as a whole.

When the canal was built gages were located at Sta. 10 + 00, 158 + 35 and 170 + 08. The gage at Sta. 10 + 00 is in an earth section, 600 ft. above the standard open-canal shapes, and is of the slope type, supplemented by a float gage. The latter is so arranged in an electric circuit as to ring a bell if the rise or fall of the water surface exceeds a predetermined limit. By the use of this gage a uniform discharge is maintained. The gages at Sta. 158 + 35 and 170 + 08 were installed for experimental use in determining Kutter's *n* and were so placed as to show the depth of water in the standard section at their situation.

TIETON IRRIGATION CANAL HAS CIRCULAR SHAPE AND IS LINED WITH REINFORCED CONCRETE

Readings were obtained by the watchman at the headworks. It was his custom to read the gage at Sta. 10 + 00 as he started his daily patrol, pass on down the canal and take the lower gage readings. These readings are fairly reliable, as the water in the canal flows faster than a man can walk.

The alignment of the canal involves numerous curves



ALL THE CURVES IN THE CANAL WERE TO THE RIGHT BETWEEN THE LOWER GAGES

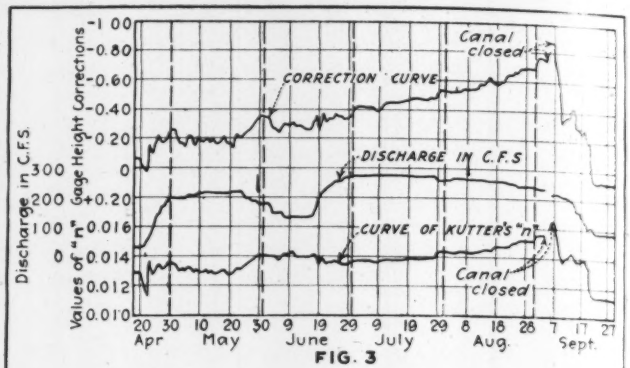


FIG. 3

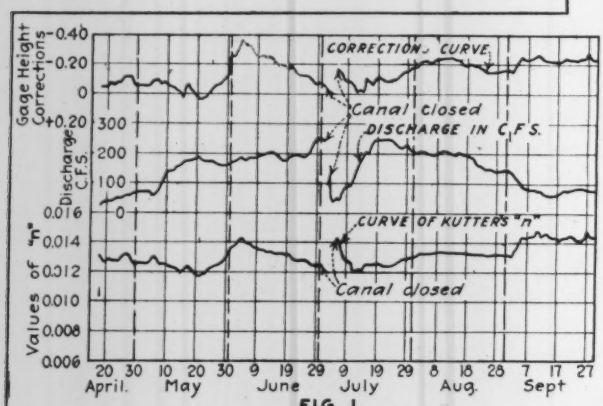


FIG. 1

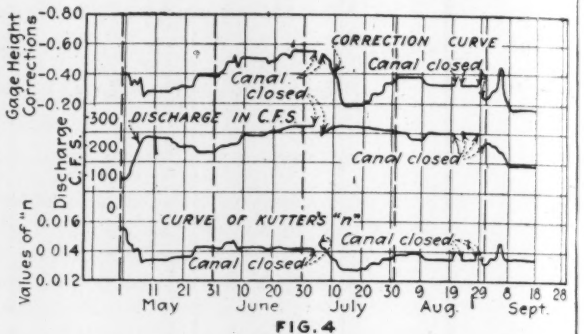


FIG. 4

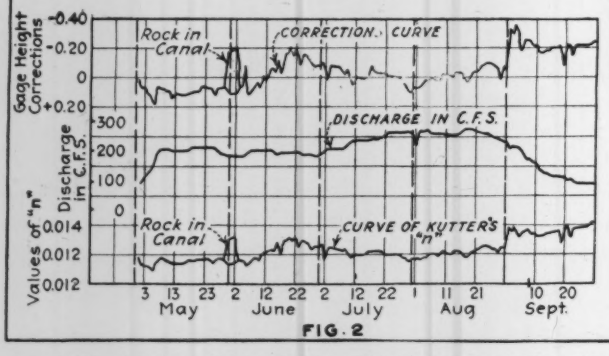


FIG. 2

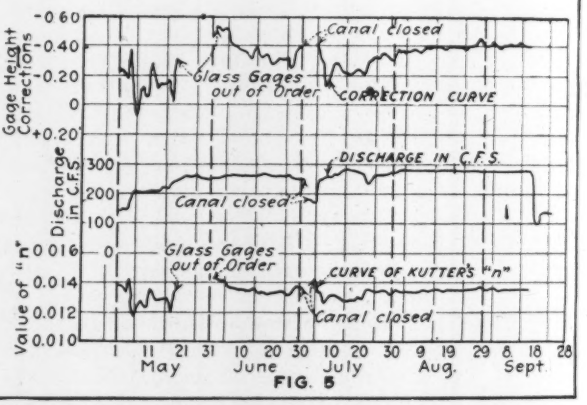


FIG. 5

FIGS. 1 TO 5. CORRECTION CURVES WERE USED TO GET VALUES OF KUTTER'S n IN TIETON MAIN CANAL
All the observations were made between Sta. 158 + 35 and 170 + 11. The correction curve assumes $n = 0.012$ as correct.

varying from 10° to 100°, many of which are reverse and some of which change the direction more than 90°. It so happens that the general direction between the gages is that of a curve to the right. There are no reverse curves in this stretch, and the sharpest curve encountered is 30 degrees.

Knowing the discharge of the canal secured through the gage at Sta. 10 + 00, the discharge at the lower gages is known, since the losses between are very slight. From the five years' observations a fair record of the variation of n was secured. Knowing the slope, the depth of water and the value of hydraulic radius for different depths, discharge curves for the lined sections based on the Kutter and Chezy formulas were computed and drawn, using values of $n = 0.012$, 0.013, 0.014 and 0.015. The mean observation of both lower gages and the discharge were platted on the curves and the value of n for that particular condition was obtained. From these data the n curves, Figs. 1 to 5, were drawn. The discharges in second-feet are also shown graphically, while the correction curve shows the increase or decrease in depth, depending on whether n is greater or less than 0.012, it being assumed that this value was correct. Negative corrections therefore indicate an increased depth. From a study of these curves it is seen that the value of n generally increases as the season advances, due to the growth of algae on the canal sides.

The lowest portions of the shapes have scoured down to a good wearing surface which is rougher than the higher sides. Fig. 6 plainly shows that the roughness does not vary with the quantity carried, because of the continual changes due to the algae growth. This seasonal growth produces a roughness on the higher sides equivalent at least to that of the bottom wearing surface. In appearance the algae were fine, pale green, hairlike growths, reaching a length of almost 2 in.,

SUMMARY OF VALUES OF KUTTER'S n IN LINED OPEN IRRIGATION CANAL, YAKIMA PROJECT, WASHINGTON

Construction Stations From	To	Actual Distance, Ft.	Slope of Subgrade	Value of n Mean	Max.	Min.	Dates Data Were Secured		
16+00	77+18	6,100	0.00165	0.0133	0.0144	0.0122	7-12-16.	7-13-16.	7-14-16
77+18	91+18	1,400	0.00168	0.0139	0.0145	0.0121	7-14-16.		
91+18	103+18	1,200	0.00161	0.0133	0.0138	0.0128	7-14-16		
103+18	156+04	5,300	0.00168	0.0135	0.0147	0.0121	7-14-16.	7-15-16	
158+35	170+08	1,176	0.00175	0.0137	0.0142	0.0129	7-31-15		
292+40	320+00	2,760	0.00161	0.0124	0.0135	0.0111	7-22-15.	7-23-15	
320+00	340+00	2,000	0.00165	0.0127	0.0140	0.0119	7-23-15.	7-24-15	7-26-15
340+00	360+65	2,000	0.00175	0.0126	0.0132	0.0115	7-26-15.	7-27-15	
360+65	365+56	500	0.00168	0.0126	0.0132	0.0119	7-27-15.		
365+56	375+16	960	0.00195	0.0126	0.0132	0.0114	7-27-15		
375+16	377+40	905	0.00220	0.0146	0.0160	0.0129	7-27-15.	7-28-15	
377+40	389+96	1,205	0.00199	0.0139	0.0148	0.0116	7-28-15		
389+96	407+56	1,760	0.00175	0.0136	0.0146	0.0116	7-28-15.	7-29-15	
407+56	440+30	3,240	0.00165	0.0133	0.0141	0.0126	7-29-15.	7-30-15	
456+84	459+16	230	0.00199	0.0139	0.0146	0.0130	7-30-15		

and were attached to the sides of the canal in a green strip about 3 in. wide at the water surface. Each season they become seeded in the concrete at the water mark, producing a series of green horizontal bands when the water is turned out at the height of the season. Constant discharge seems productive of rank growth, while a variable discharge has a retarding effect. When the canal is closed for a few days the growth seems to dry up. It scales off when the water is turned in, causing n to increase at first. As the scale wears off n decreases. In a short time the growth starts again, and increases unless the season is too far advanced. Light is necessary for the growth of the species, as none is found in the tunnels. Warmer temperature also produces ranker growth. During the year 1915 the growth seems to have been early, the season being long with an unusual low-water period and a discharge consequently warmer than the average.

In contrast, the 1916 season was short and the water was cold, due to an exceptionally heavy snowfall and a late season, and as a result so rank a growth was not produced. Fig. 3 is exceptionally interesting, as the 1914 runoff was slightly below the average with a long warm season. The value of n varied from approximately 0.013 to 0.0155. The increase in value was almost constant and produced an increased depth of 0.76 ft. greater than that required at the beginning of the season, which means that 0.76 ft. of freeboard was absorbed by the variation of n. These data are based on mean water surface conditions only. Local conditions produce considerable variation between maximum and minium water surfaces.

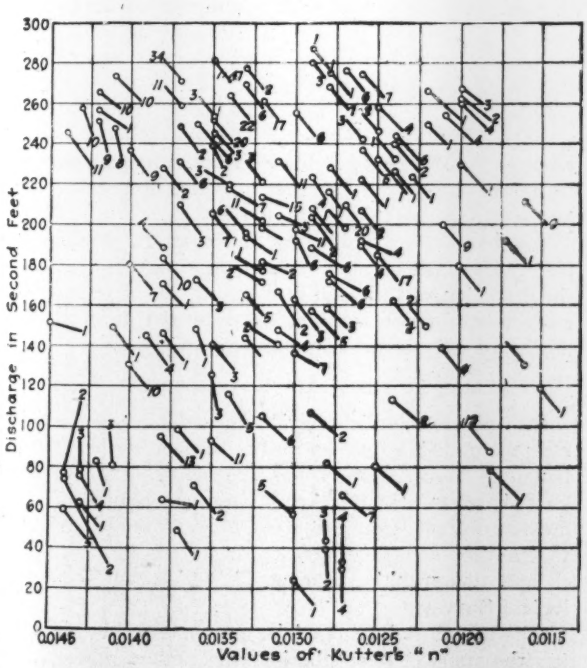


FIG. 6. MEAN VALUES OF KUTTER'S n BASED ON TIETON STUDIES MADE DURING SEASONS 1912-16

The figures given show the number of observations made to secure each mean value plotted.

Having obtained some idea of the conditions affecting n between the lower gages, it was desirable to find if these conditions were applicable to the remainder of the structure. Accordingly, during 1915 and 1916 levels were run over most of the canal, obtaining mean maximum and mean minimum water surfaces and elevations of cross-arm bottoms at center, left and right, taken usually at 10-ft. intervals, this distance being greater or less, dependent on the field conditions at the locality in question. The accompanying table summarizes the data thus obtained.

From a study of this table and Figs. 1 to 5, it is evident that, due to the growth of algae, 0.014 seems a fair value of Kutter's n, and that the data secured from the stretch between the lower gages is applicable to the canal as a whole, except localities influenced by curvature, offsets of shapes at joints, settlement of canal foundation, insertion in the canal of wasteway sumps, and velocity irregularities caused by transitions, where allowance should be made for increases in n from 0.001 to 0.002. No data were obtained on the variation of n in the tunnels. This variation is probably not so great as in the open canal, as the growths therein are of a thin, fungoid nature and appear to possess less tenacity than the algae.

Advocates Licensing Drivers of All Vehicles

The advisability of properly licensing all drivers of vehicles in the cities of the first and second classes in the State of New York was called to the attention of the mayors' conference at Newburgh, N. Y., June 11. Police Commissioner Richard C. Enright of New York stated that this would not only give the police authorities a control over chauffeurs, making them more accountable, but would eliminate a class of drivers who employ trucks for petty thieving, and who make up a considerable part of the criminal classes in the cities.

Army Engineer School in France Standardizes Work in the Field

Gives Courses of Training to Men Recommended for Commissions—Operations Conducted Mostly in the Open—Classes Trained in Mining, Pioneering, Bridging, Topography, Camouflage, Sound Ranging and Interpretation of Aërial Photographs—Model Battle Sector Laid Out and Completely Equipped

By Robert K. Tomlin, Jr.
War Correspondent of Engineering News-Record

(Concluded from last week)

THE British say that "an army advances astride a 4-in. pipe." To familiarize our students with water-supply, they are taught the organization of our water-supply service, and the requirements of men and animals in gallons of water daily, and they are warned of the probable difficulties they will encounter. To make these difficulties appear more real, they are worked into interesting water-supply problems, approximating as closely as possible those which occur daily in trench warfare, and which graduates of the Engineer School will be undoubtedly called upon to solve. Working out such examples in a classroom has proved excellent training for the efficient execution of water-supply schemes at the front. The accompanying British official photographs show the kind of water-supply work done at the front.

The inclusive heading of "Pioneering" takes in practically every subject in military engineering except those specifically relating to mines or bridges, and everywhere at the Army Engineer School one sees encouraging evidence that no point has been overlooked.

Sound Ranging

Students at the school are receiving instruction in certain highly specialized phases of mapping and plotting in connection with artillery work. Among these is sound ranging—the registering of an enemy battery by means of apparatus operating on the general principle of a seismograph. It is disclosing no secret to outline the general principles of this work as practiced by the American Army, inasmuch as the scheme has already received publicity in the French press. In fact, one of the papers gives to French sound-ranging apparatus the credit for locating the long-range guns which have been bombarding Paris since the German drive began, although it is asserted in other quarters that *la grosse Bertha* was spotted by means of aërial photographs.

Briefly, the sound ranging work involves the installation of recording apparatus at three points, some distance apart, the location of each being definitely known in advance. The detonation of an enemy gun will be heard at point A at a certain time, at point B, let us say, a second later, and at point C, two seconds later. Knowing the velocity at which sound travels, it is easy to determine that the gun is a certain distance, x, nearer A than B. By taking A and B as origins, plotting pairs of circles, one radius always being longer by x than the other, and connecting the intersections, we get a curve on any point of which the enemy gun may be located. This curve is obviously a hyperbola, for the difference between the distances of any point on it from the two fixed points, or foci, A and B, is always the same.

Repeating this performance for points A and C we plot a new series of circles, the radii differing in this case by a distance of y corresponding to the time elapsed between the recording of the sound of the shot at A and at C. Again connecting the intersections of these pairs of circles, we get a second hyperbola which forms another locus of points for the gun position. Obviously, the intersection of these two hyperbolas gives the true position of the battery which is doing the firing.

Of course the actual registering of a battery position does not involve all of the clumsy details cited above to explain the principle of the method. Graphical charts have been developed for accelerating the interpretation of the data, and the recording apparatus operates with sensitized paper, which passes into a chemical developing solution and is ready for use in a very short time.

The first thought that comes to mind is that with many guns firing along the front the work of interpreting the sound records would be exceedingly confusing. To some extent this is the case, but with a proper location of the recording posts and practice in reading the records, surprisingly accurate results are obtained. It must be remembered that a gun will probably fire a number of shots from one position and that every time the same *series* of time intervals will be recorded at the three observation posts. Thus, by comparing several records which are apparently complicated by other sounds than that from the gun it is desired to register, it is possible to identify the recurring *series of three marks* on the sensitized paper, eliminate others and spot the position of the battery.

Another aid to confirming the position of an enemy field piece is the method of flash ranging; that is, taking the direction of the flash of a gun at night from two or more posts of observation, the intersection of the azimuths, of course, disclosing the gun positions.

Aërial Pictures Aid Topographical Work

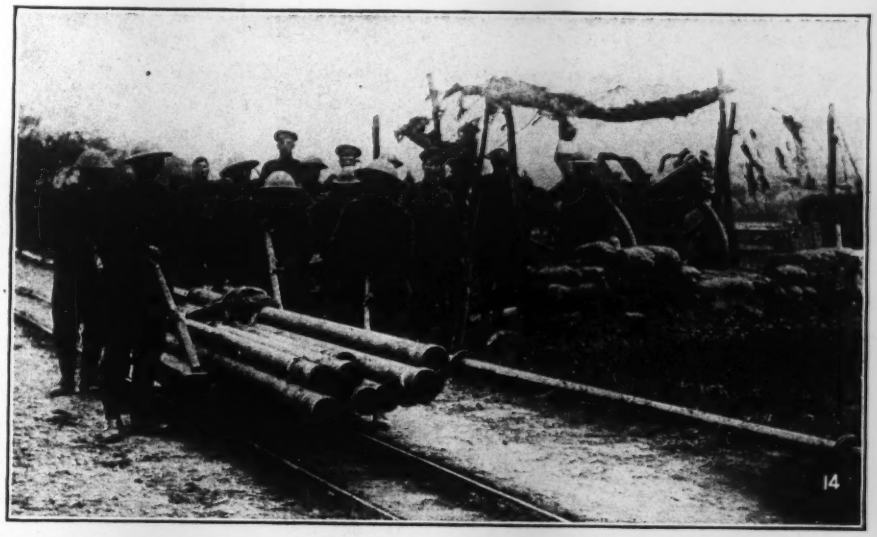
In a previous article, in *Engineering News-Record* of May 23, p. 984, I touched on the subject of the interpretation of aërial photographs for mapmaking and artillery purposes. At the Army Engineer School I had an opportunity of seeing a class being instructed in this fascinating branch of work; the officer in charge is a former topographic engineer of the United States Geological Survey.

The aërial picture must be accompanied by data giving the approximate height of the camera when the exposure was made, the date and time of day, direction of north, etc. It is examined under lenses and stereoscopes, the latter bringing out objects in relief. The study of shadows is a vital part of the work, for where

camouflage covers up an object from a point of observation overhead the shadow it casts is often the telltale mark by which important bits of information are disclosed. It is clear, therefore, that in the interpretation of shadows it is desirable to know the time of day at which the picture was taken.

Tracks or trails of any sort also are carefully studied, for they always mean activity of some kind—possibly the delivery of ammunition to a dump which is otherwise protected from observation by camouflage. A favorite enemy trick is to place "dummy" batteries in the field to fool the mapmakers. Absence of a track or trail leading to these places shows them up as "fakes." Sometimes, too, "faked" tracks and blast marks are fixed up with the white chalk so abundant in the war zone of France. The canny interpreter of photographs, however, is not misled by these subterfuges.

All of these data are reduced to map form by means



THE BRITISH SAY: "AN ARMY ADVANCES ASTRIDE A FOUR-INCH PIPE LINE." AT THE ARMY ENGINEER SCHOOL OUR MEN ARE TRAINED IN WATER-SUPPLY WORK, THE SCOPE OF WHICH IS INDICATED BY THESE BRITISH PICTURES

FIG. 14. BRINGING UP WATER PIPES TO SUPPLY THE FRONT LINE

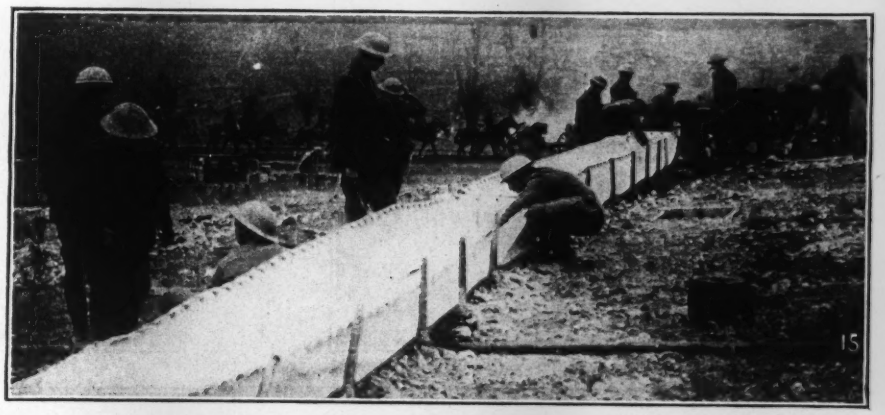
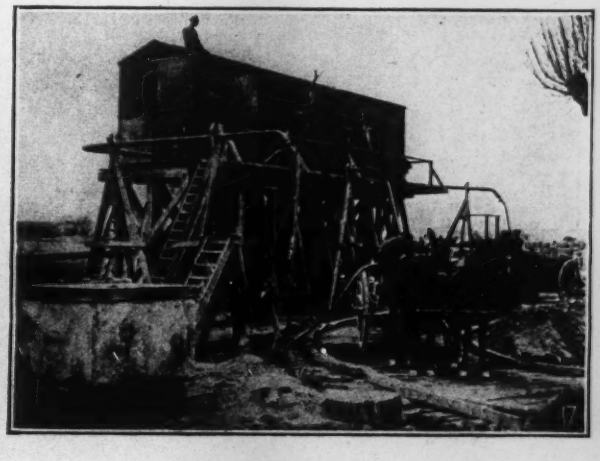


FIG. 15. PUTTING UP A WATER TROUGH FOR THE CAVALRY

FIG. 16. TEMPORARY WATER TANKS

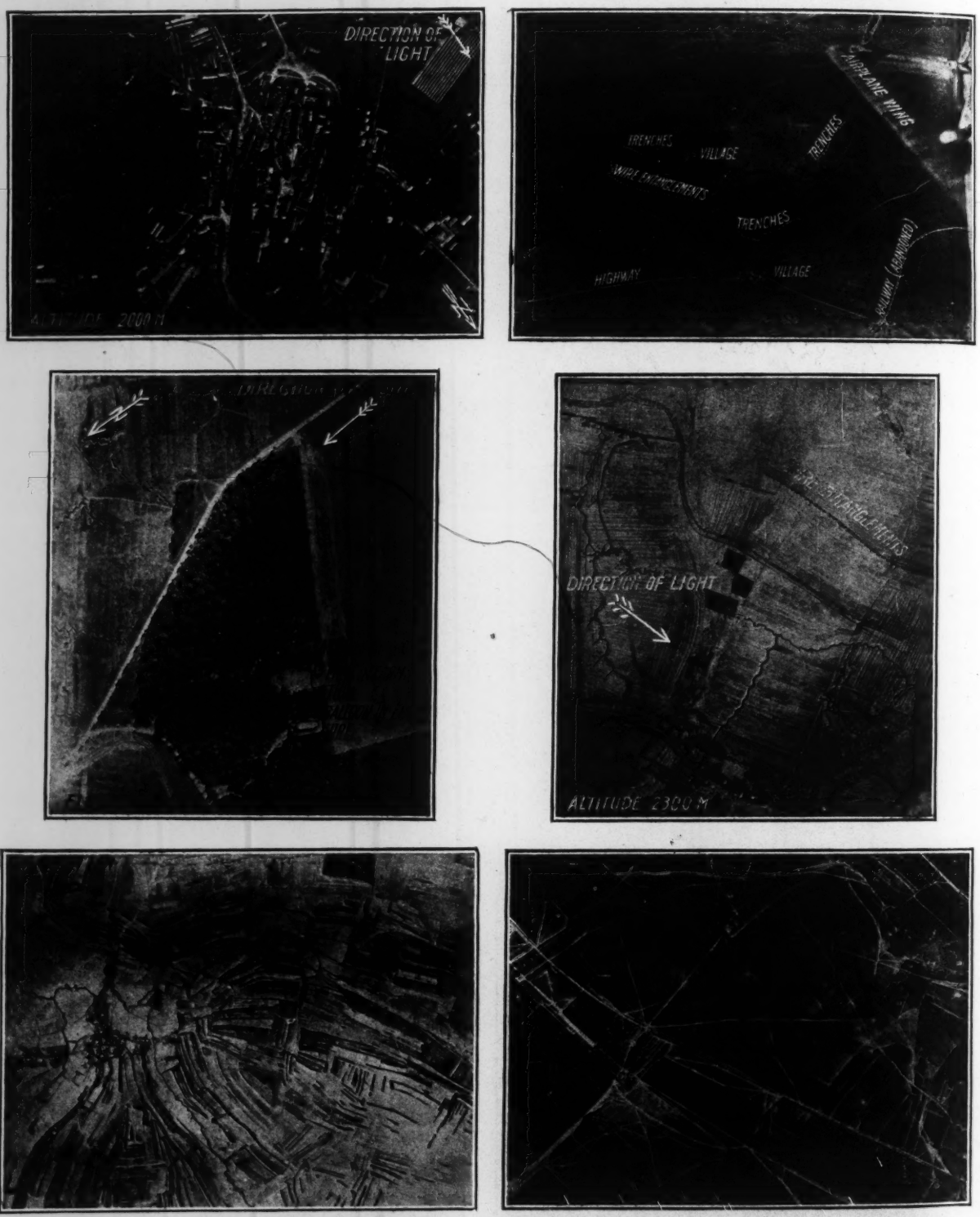
FIG. 17. A BIG WATER DEPOT



British Official Photographs.

of straight-line intersections, by the use of the *camera lucida* and the *appareils roussilhes*. The first named method is most generally used, and the several steps are as follows:

On the photograph, select four points easily identified on the map, which are so situated that the lines joining them intersect on or close to the particular detail it is desired to fix. On the map, draw lines joining the corresponding points. The intersection of these lines will give the true position of the particular detail



THE INTERPRETER OF AERIAL PHOTOS MAKES SUCH AS THESE (ON WHICH THE LETTERING HAS BEEN SUPERIMPOSED) TELL AN IMPORTANT STORY

in question. The remainder of the detail can be quickly drawn in with the aid of proportional compasses. This method simplifies the matter of adjusting errors.

The *camera lucida* is nothing more than a prism mounted by means of extension rods upon a light wooden framework comprising a base and a sliding easel. The photograph is pinned on the easel, and the map on the drawing board, the plane of the photograph being perpendicular to the plane of the map. Looking vertically through the prism, a faint image of the photograph is projected down on the map, and with a pencil small sections at a time are traced.

The *appareils roussilhes* method is carried out by means of an *optique cinématographique.* A photographic plate is used and the image thrown on the map in the same way screen pictures are shown. By various adjustments of the instrument the proportion of the image projected on the map is reduced or enlarged until it fits the map scale, and then the lines are traced. The accompanying aërial photographs show the kind of material that must be made to reveal its story.

The topographic section of the school, of which the interpretation of photographs is a part, also gives instruction in map reading, surveying and landscape sketching, and includes an artillery orienting course.

The camouflage section has a wider scope than any other in the Engineer School, inasmuch as camouflage must be applied to every branch of the service. It includes heavy artillery; field artillery; trench mortars, light and heavy; gas projectors; dugout and mine entrances with spoil banks; observation and listening posts of many types; tanks; snipers' posts, and the numerous not-to-be-described "fakes" and front line work.

Many people have the idea that camouflage work is mostly done by artists, painting in studios far removed from the front. About one per cent of it is produced in studios. The rest is military engineering erected under fire, and the camoufleur must have a working knowledge of all *materiel* of war.

On account of the broad scope of camouflage, the students in this section of the school range from major generals to privates. Special attention is given to camouflage discipline. Another interesting study is the camouflage of shadows, which are successfully concealed.

It is obvious that this subject can not be written about in detail. *The familiar illustrations often published in magazines and newspapers are the obvious and theatrical ones, seldom used. The real camouflage would not make an interesting picture, because no one would see it in a photograph.*

The Army Engineer School, to the technical man, is one of the most interesting places in France today. It is, in effect, a museum where one sees the practical application of the new military engineering.

Railway Engineering Association Assigns Work for 1918

COMMITTEE work of the American Railway Engineering Association during 1918, as assigned by the board of direction, is to continue largely on lines and subjects already under consideration. The principal new subjects are noted below:

Ballast—Design of gravel-washing and stone-crushing plants.

Buildings—Design of buildings for track laborers; toilet facilities for small stations without water or sewers; electric lighting of passenger stations and platforms.

Wooden Bridges and Trestles—Specifications for construction timbers and for timber which is to be treated by a preservative process.

Masonry—Concrete culvert-pipe; depositing concrete under water; concrete in sea water; specifications for slag aggregate; relation of moisture to strength and durability of concrete.

Signs, Fences and Crossings—Manufactured fence posts; strain posts for use with steel posts; bracing concrete end or strain posts.

Signals and Interlocking—Short-circuiting track circuits to display signals for protection of track workers; code of signal rules; time interval for release of devices on switch or signal apparatus.

Records and Accounts—Filing plans in connection with estimates; forms for analyzing expenditures.

Rules and Organization—Rules for construction, maintenance, operation and protection of buildings to reduce fire risk; rules for inspection of bridges and culverts.

Water Service—Locomotive tube failures due to improper water conditions; methods of treatment to correct such conditions.

Yards and Terminals—Unit operation of terminals in large cities; use of a small gravity sorting yard between the classification and advance yards for the purpose of switching cars into station order.

Iron and Steel Structures—Track-scale superstructures; flashing, drainage and reinforcement for waterproofing purposes.

Wood Preservation—Treatment of Douglas fir; indicators for determining the burnetizing of ties.

Economics of Railway Operation—Increasing traffic capacity; analysis of operating costs; effect of train speed upon cost of maintenance; economic length of operating districts; distribution of maintenance expense between passenger and freight service; reclamation and utilization of scrap.

Economics of Railway Labor—Organizing to obtain a labor supply; equating track sections; plans for boarding cars and boarding houses; determining a normal maintenance expense; separation of expense between track, signal and bridge and building departments; ratio of labor cost to total cost; labor-saving devices.

New chairmen have been appointed for six committees. G. J. Ray succeeds John D. Isaacs as chairman of the rail committee, and is succeeded as chairman of the track committee by J. R. Leighty; W. H. Hoyt succeeds E. A. Frink as chairman of the committee on wooden bridges and trestles; W. H. Finley follows Joseph Mullen as chairman of that on rules and organization; B. H. Mann replaces E. B. Temple as head of the committee on yards and terminals, and C. M. Taylor replaces Earl Stimson as chairman of that on wood preservation.

Repair Washout Under Dam by Sheet Pile Cutoff Embedded in Concrete

Hole in Cutoff Wall and Deep Erosion of River Bed Contribute to Accident—Closure to Coon Rapids Dam Made Rapidly Behind Steel Sheet-Pile and Timber Crib Cofferdam in Reservoir

PREPARED BY THE STAFF OF H. M. BYLLESBY & CO., CHICAGO

A WASHOUT through the pile foundation of the Coon Rapids dam in the Mississippi River, 11 miles above Minneapolis, occurred on Sept. 1, 1917. By energetic work in planning and carrying out the repairs rapidly in spite of difficulties, the power plant was put in operation again on Feb. 24. The break was due primarily to a gap in a steel cutoff wall beneath the face of the dam. The leakage saturated the material under the dam and caused a large cavity. Erosion beyond the toe of the apron below the dam contributed to the accident by forming a deep hole and thus increasing

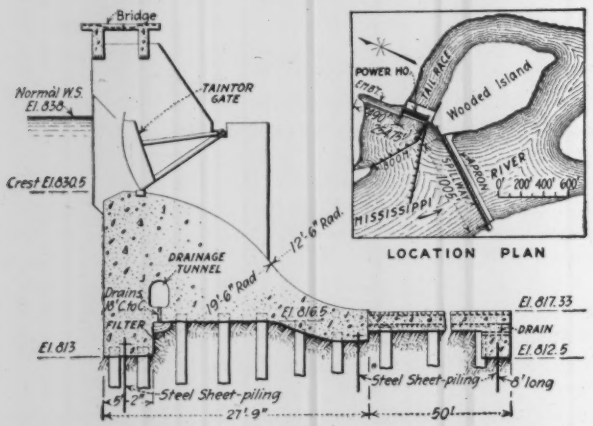


FIG. 1. CROSS-SECTION OF SPILLWAY DAM AND APRON AS BUILT AT COON RAPIDS, MINNESOTA

the head against the cutoff wall. The break occurred during the repairs on the hole in the river bed, and these repairs were carried on simultaneously with the closing of the break under the dam.

The Coon Rapids dam is part of the hydro-electric plant of the Northern States Power Co., a development of 10,500 hp. under a normal head of 17½ ft. The entire plant was designed by H. M. Byllesby & Co., and was built by day labor under their direction as engineers and managers for the power company. It was completed early in 1914. The repair work also was planned and carried out by the Byllesby company. When plans for repairing the dam were under consideration this company called into consultation J. G. Giaver, Chicago, and Francis C. Shenehon, Minneapolis.

The concrete spillway dam, under which the blowout occurred, is of the gravity type, with a height of about 21 ft. and a base width of 27 ft. 9 in., as shown in the cross-section, Fig. 2. It is built on a glacial drift formation. The south bank, to a height of about 20 ft. above low water, is a so-called hardpan, but is really only a mixture of sand, gravel and clay, very hard and dense in places, though easily crumbled in the fingers when broken off in small pieces. It is practically impervious to any head created by the dam. This hardpan has a decided dip to the north, and after passing below the river bed is overlaid by a deposit of clay containing a considerable percentage of very fine sand. The clay deposit, extending in general from the river bed down to the hardpan, is interspersed with pockets of sand of varying degrees of fineness. Near the head of the island at the north end of the spillway it is overlaid by a deposit of boulders and sand. The accident occurred in this vicinity.

Wood piles were so driven as to insure a safe bearing value of 10 tons per pile. Cutoff walls of steel sheeting were placed under the heel and the toe of the dam; the sheeting was driven to such a depth as to penetrate at least 5 ft. into material that would be impervious under the head developed at the dam. This depth was determined by test borings; the maximum length of the steel piles was 25 ft. A 50-ft. concrete apron beyond the toe of the dam is also carried on wood piles, and has a toe wall with a line of 8-ft. steel sheeting to prevent scour from cutting back under the apron.

The dam with its gates and other works was described in *Engineering Record* of Jan. 17, 1914, p. 77, and in *Engineering News* of July 16, 1914, p. 118.

Locating the plant at the head of an island (see key plan in Fig. 1) gave a 1000-ft. spillway across the south channel and a 255-ft. power house across the north channel; the total length between abutments is about 2000 ft. Formerly the north channel, being the deeper of the two, carried probably more than half of the flow during floods, but since the works were built practically the entire flood-flow goes over the spillway into the shallow south channel. This condition was a factor in the erosion which took place below the dam. It was assumed that with the high velocity in the south channel, due to its greatly increased discharge, there would be some scouring until the river reëstablished a permanent condition of flow.

The history of the case is as follows: In January, 1914, the dam and the power house substructure were completed and the gates were then closed. The spring flood, which was not of large proportions, carried over the spillway a quantity of logs. Soundings made after the flood showed that considerable erosion had taken place, but not near the apron; it was deemed safe to await further developments.

The spring flood of 1915, considered to have been the maximum for this part of the river, amounted to more than 60,000 cu.ft. per second. Soundings made in the fall showed that irregular scouring had proceeded along the entire length of the spillway. The condition was such as to make it necessary to carry out protective work before the next flood. For this purpose rock-filled timber cribs about 24 ft. wide, with their tops be-

ow the top of the apron, were sunk against the toe of the apron for something more than half the length of the spillway section.

Soundings made in the winter of 1916-17 showed that the cribbing had been damaged considerably. The erosion also had extended so that protective work of a more extensive character was rendered necessary. After a contour map of the river bottom had been made from soundings, and studying the situation, it was decided that during the following summer a cofferdam should be built around the hole to admit of pumping out the water and placing a concrete floor or paving. Arrangements were made to carry out this work after the high water of 1917.

The spring flood of 1917 carried large quantities of logs and heavy ice over the spillway, so that although the flood was not nearly so great as that of 1915 it caused probably more scouring than any previous flood.

Construction of the cofferdam was commenced in June. An area below the apron two-thirds of the length of the dam was inclosed. Owing to the low stage of the river only an earth embankment 3 to 5 ft. in height was required to keep out the backwater. On Aug. 11, 1917, the hole was unwatered, and on Aug. 31 all was ready for filling it with concrete the next day.

No leakage or even seepage had been observed as coming from under the dam. At 2 a. m. on Sept. 1, however, the watchman noticed that the water in the hole was gaining on his pumps. He reported this immediately to the superintendent through the operator at the power house, but the flow developed so rapidly that the hole was filled with water before anything could be done to stop it except to open the sluice gates and thus hasten the lowering of the pond level.

Steps were taken immediately to build a rough cofferdam of rock-filled timber cribs faced with wood sheeting driven by hand, so as to obstruct the flow of water under the dam and thereby retard or stop the erosion. In the meantime the ends of the break were covered with brush and sand bags to prevent it from widening.

As this temporary work progressed, materials were ordered for a more substantial cofferdam in the reservoir, the construction of which was commenced with steel sheet piling on hand in Minneapolis. Additional piling was rushed from Buffalo and Louisville, so that the floating driver was not delayed for lack of material. This cofferdam was about 350 ft. long, with its face about 150 ft. upstream of the dam. It consisted of steel sheeting driven to a penetration of about 30 ft. and supported by rock-filled cribs 16 and 24 ft. wide. The earth cofferdam around the scoured hole below the dam was repaired where it had been breached by the washout, and it served its purpose until the completion of the repairs.

During the period of repair the river flow was taken care of through the wheels and the sluice gates. Provision was made for raising those portions of the cofferdam not already up to 3 ft. above the crest of the dam, in the event that high water should be reported from upstream stations.

When the cofferdam was pumped out it was discovered that a hole about 200 ft. long had been eroded under the concrete dam. This hole was about 26 ft. deep at the center and sloped up to the base of the dam at each end. The foundation piles were not undermined, so that they sustained the load, and no portion of the dam was lost or seriously damaged. There was no settlement or sign of distress. The two lines of steel sheeting under the dam were not damaged, but they were undermined at the break by the washout. Two 54-ft. sec-

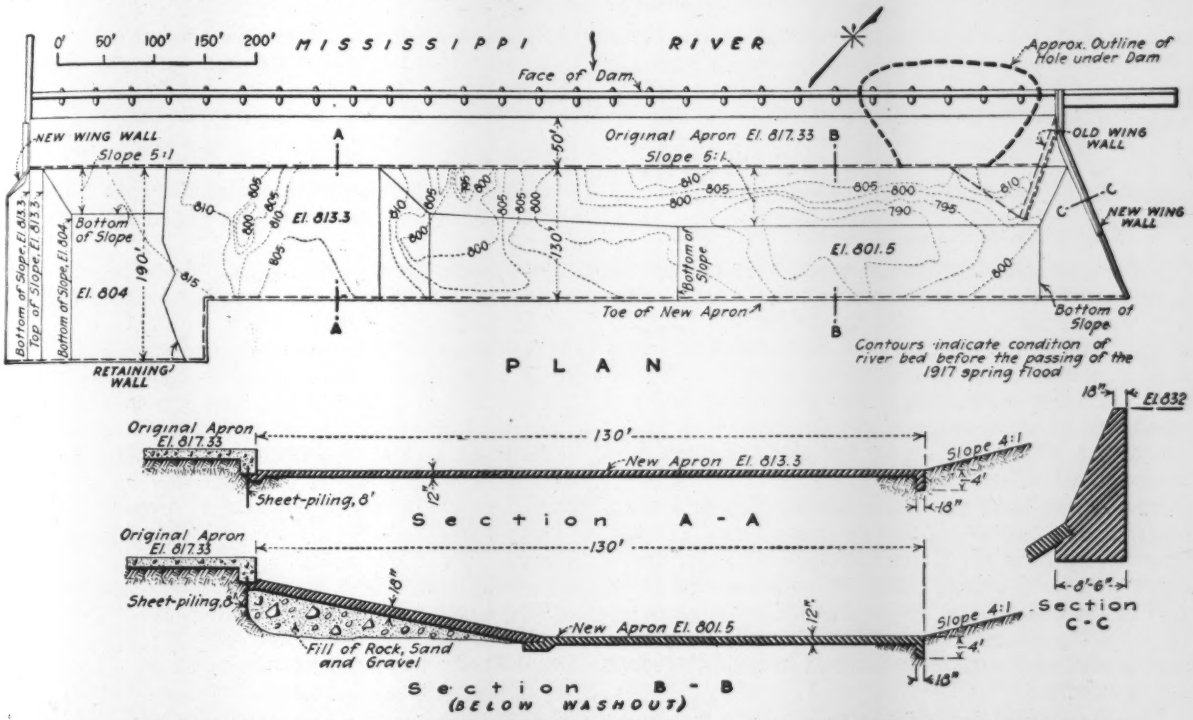


FIG 2. FIVE BAYS OF DAM UNDERMINED BY WASHOUT—NEW APRON BUILT OVER SCOURED-OUT AREA

tions of the apron collapsed, as the shorter foundation piles and sheeting under the apron were undermined.

In the original construction of the dam, the sheeting and foundation piling in the portion where the washout occurred were driven from the ice before the cofferdam was built. The steel sheeting was driven first. Considerable difficulty was experienced on account of boulders and old logging cribs. There was some apprehension that these obstructions might split the webs of the piles or pull the interlocks apart, but nothing of the kind was discovered.

Examination of the sheeting exposed by the erosion, however, revealed the fact that when one of the bearing piles was driven it had been set on top of a steel pile and, while the former was badly split, it had nevertheless carried the head of the steel pile to the bottom of the adjacent piles, thus leaving a slot partially filled by the wooden pile. When the excavation was made for bedding the heads of the steel piles in concrete this opening should have been discovered and a new pile driven to close the opening, but if it was noticed by the inspector it was covered up without the defect being remedied. This opening through the cutoff wall is considered the cause of the accident, beyond doubt.

Three Plans for Work Were Considered

Three plans for the repair work were considered, though two of these differed only in detail. As the driving of additional piling under the dam seemed impracticable, and as the original steel cutoff wall had been undermined at the break, the main points to be determined were the bearing value of the clay and the possibility of constructing a new cutoff wall or waterstop which would tie in with the original cutoff wall beyond the limits of the break.

Plan A was to fill the hole under the dam with 1:3:6 concrete, and face this on the upstream side with 1:2:4 concrete, incasing the heads of the steel piles of a new cutoff wall to be driven about 5 ft. upstream from the face of the dam. Plan B was practically the same, except that the concrete was to be of a very lean mixture, approximating the adjacent hardpan in rigidity though not in density.

Plan C provided for a reinforced-concrete mat under the dam, extending from the downstream side of the original cutoff wall a sufficient distance beyond the toe to distribute the pressures properly. Cross-walls resting on this mat would support the undermined portion of the dam. After cutting out the two upstream rows of bearing piles a reinforced-concrete cutoff wall would be built in line with the original cutoff, bearing against the upstream ends of the cross walls and carried down to bond into the hardpan. The spaces between the walls were then to be filled with sand and the apron was to be restored in its original form.

Objections to Plans A and B were the increase of weight and the difficulty of bonding the new cutoff wall with the old so as to make it continuous and of equal effectiveness. The original steel cutoff is more than 2 ft. in from the face of the concrete, and as the new steel could not be driven closer to the dam than about 12 in. there would have been a gap of at least 3 ft. between the two rows of sheeting. By the removal of part of the bridge and the cutting of a slot from the crest to the base of the dam it would have been possible to turn the new line of sheeting perpendicular to the axis of the dam and drive it up to the old sheeting. But no junction with the old sheeting would have been possible, nor would there have been any assurance of contact between the two lines. This difficulty would be eliminated in Plan C because of the new cutoff wall being in the same plane as the old one, so that it would only be necessary to extend the concrete wall sufficiently to bond over the edge of the old steel sheeting.

Leakage of the cofferdam proved to be the deciding factor. Although the amount of the inflow was not serious, the water was difficult to collect and pump, and that which was not controlled seeped through the ground inside of the cofferdam and flowed into the deep part of the hole. This made excavation difficult and of questionable benefit, because any disturbance of the clay in the presence of water quickly turned it into mud. Under these conditions it was deemed too hazardous to attempt to make a deep trench excavation for the cutoff wall as required by Plan C. Plan A was therefore adopted.

Reconstruction Carried Out in Very Cold Weather

The new cutoff wall driven according to this plan was 175 ft. long. The sheet piles varied in length and were driven into the hardpan.

On account of the close spacing of the bearing piles under the dam, placing the concrete was very difficult, except in the lower part, where it could be spouted. As it was desired to get the concrete packed in so solidly against the base of the original structure as to avoid the necessity of grouting, the pneumatic method of mixing and placing was adopted. This method was not as satisfactory as had been anticipated, due largely to the adverse conditions and to the occasional necessity of operating the mixer with inexperienced help. Some difficulty was caused by the concrete clogging in the discharge pipe. This probably could have been reduced materially had it been possible to keep a trained man at the mixer. Some segregation of the materials occurred as the concrete was deposited, probably due to the difficulty of proper manipulation at the outlet of the discharge pipe on account of the interference of the bearing piles. Wear of the discharge pipe was another trouble. There was no way of ascertaining easily the amount of wear, and blowouts had a way of occurring at inopportune times. Notwithstanding the difficulties, good work was done, and it was considered that pneumatic placing was the only method practicable in the circumstances.

Most of the concrete under the dam was placed during weather that was near or considerably below zero. The space where the concrete was to be placed was inclosed by hanging tarpaulins from the original structure, all materials were heated, and salamanders were used when necessary to prevent frost getting into the concrete.

Junction between old and new cutoff walls at the south end was effected by excavating a well between the end of the new sheeting and the face of the old sheeting, down to the bottom of the former. A section of the old sheeting about 2 ft. wide was then cut out with a blow torch and sufficient excavation was made behind the sheeting to get a good bond. Finally, the well was filled with concrete placed solid against the undisturbed

earth. As the cutting and excavating proved to be difficult the method was changed when the junction at the north end was made. An angle iron was tap-bolted to the web of one of the piles in the old sheeting and the outstanding leg was embedded in the concrete. The latter method was much more easily carried out and resulted in more satisfactory work.

The toe of the new concrete under the dam was extended 10 ft. beyond the toe of the original structure, and in this 10-ft. width three lines of bearing piles were driven.

After the work under the dam was completed a fill was made on the downstream side to level up the eroded bed, and the apron at the two collapsed sections was rebuilt as in the original structure. Where erosion at the toe of the apron had taken place to a depth of 10 ft. or more, a fill with slope of 1 on 5 was so made that the concrete pavement laid on this slope bonded in under the toe wall of the original apron, as shown.

The river-bed protection was extended about 135 ft. beyond the original apron, or to about the limits of the deep erosion. In placing this protection only such grading was done as was necessary to eliminate abrupt changes of section. A new wing wall was built, flaring away from the dam so as to allow the free escape of the tail water.

Full reservoir head has been maintained since the repairs were completed, without any indication of further trouble, and it is thought that if additional erosion takes place in the river bed it will not be of such a nature as to require further protective work.

Machinery Ordered for One Purpose Cannot Be Tested for Another

Court of Claims Decides That Dry Dock Contractor Can Recover When Use for Which Engines Were Intended Is Changed

By William B. King
of King & King, Attorneys-at-Law, Washington, D. C.

IN A decision handed down by the United States Court of Claims Apr. 29, it was decided that machinery ordered for one purpose by a contractor on a naval dry-dock cannot be subjected to a test with reference to a different service from that covered by the original contract.

The case was that of the trustee in bankruptcy for the Scofield Co. against the United States Government, arising out of the contract made by that company on Mar. 9, 1903, for completing the dry dock at the Philadelphia Navy Yard. The principal question arose over the rejection of the three main engines furnished by the contractor and purchased by the Government, and the purchase in their place of more powerful and expensive engines. The three original engines were sold practically for junk, and after crediting the price obtained by the sale the cost of the three new engines was charged to the contractor.

The three engines originally furnished were found on final test to have a speed regulation which did not come up to the requirements of the specifications. The contractor, as well as the subcontractor, the maker of the engines, endeavored to bring them within the specification requirements. While this work was in progress the contracting company became financially involved and the Government took over the completion of the dock and the machinery.

The Government then made a contract with the Providence Engineering Works to alter the three engines to bring them within the specifications. One engine was to be altered, and if it were satisfactory $8400 was to be paid for altering all three. It was agreed that if the alteration of the first engine was unsatisfactory, it was to be returned to its original condition and nothing was to be paid for the work done.

The first engine was altered, and failed to meet the test. It came so near it, however, that the Providence Works asserted that by further slight alteration it could be brought within the specifications. The Government, however, paid the Providence Works a proportionate part of the agreed price for the alterations, rejected all three engines and sold them at a small price. Three larger engines were then purchased and charged to the contractor.

While the original contract was solely for a dry dock and machinery to operate it, the tests of the engines were conducted with reference to their capacity to operate not only the dry dock but a central station which would furnish heat and light for the entire yard, and power for all the shops in the yard. The court held that no such requirement could be made, and that the contractor had complied with all his obligations when he furnished engines capable of operating the machinery and dry dock. Therefore, it credited the contractor with the price of the new engines, and held that from this there must be deducted the price which it would have cost the Government to have the Providence Engineering Works alter the old engines to bring them within the specification requirements. Subject to this credit of $8400 the contractor recovered from the United States the increased cost of the new engines.

The case was presented for the contractor by the writer and Russell H. Robbins, of New York, while Philip G. Walker appeared for the Government with Assistant Attorney General Houston Thompson.

Culvert Maintenance Cheaper Than Upkeep of Bridge Floor

REPAIR on the road surface has been found to be the most expensive item in the maintenance of canal highway crossings in the South San Joaquin Irrigation District of California. As a result, culverts which can be jacked beneath paved surfaces without disturbing the roadway are considered to be very much cheaper than small bridges or culverts of the type which involve the removal of the highway surfacing. Large pipes therefore are used in place of the old type bridge-culvert whenever feasible. By using two or more pipes in parallel, ditches of comparatively large capacity have been provided for at crossings. Corrugated iron pipes as large as 48 in. diameter are now being successfully jacked under highways. A description of the method of jacking appeared in *Engineering News-Record* of June 27, p. 1236.

Concrete Road Resurfaced with Concrete in Good Condition

After Two Years' Service, Inspection Shows No Separation Between the Base and the Three-Inch Reinforced-Concrete Cover

A CONCRETE road in Wayne County, Michigan, which was resurfaced two years ago with 3 in. of reinforced concrete, and which has passed through two severe winters, was recently inspected by a representative of *Engineering News-Record* and found to be in almost perfect condition. Some immaterial longitudinal cracks have developed down the center, but none of these is over the joint between the old pavement and the extra width which was added when it was resurfaced. No separation has occurred between the resurfacing and the base, so far as can be determined. A description of the construction and the methods employed in resurfacing was given in a paper presented before the Portland Cement Association by Edward M. Hines, chairman of the board of county commissioners of Wayne County, which was published in *Engineering Record* of Oct. 7, 1916, p. 434.

The work was done as an experiment, and a section of the Grand River Road built in 1910 which is subjected to very heavy traffic was selected for the experiment. The original road was of two-course concrete construction and was 16 ft. wide. The bottom course was 4 in. thick and made of 1:2½:5 concrete. The top course was 2½ in. thick and made of 1:2:3 concrete. The slabs were 25 ft. long and were separated from one another by expansion strips of tar paper ¼ in. thick which extended entirely through the slab. The pavement, being six years old, had received the usual amount of maintenance, and the cracks and holes had been filled with tar. On account of the heavy traffic upon this road, it was decided to widen it from 16 ft. to 20 ft. by adding a 2-ft. strip on each side. To secure a good joint, the edges of the pavement, where they had rounded off, were chipped off, and, the excavation having been made, 6 in. of 1:2:4 concrete was placed. Before the resurfacing was proceeded with, the surface of the old pavement was thoroughly cleaned. The Tarvia which had been used to make repairs was thoroughly cleaned from the holes and cracks, and these were filled with concrete, thus bringing the entire 20 ft. of surface to an even bearing for the cover which was to be laid. Where expansion joints had cobbled they were cleaned and repaired.

After the foundation had been prepared and immediately before the new surface was laid, the base was sprinkled with water and received a coating of Tarvia A and Tarvia X mixed, which mixture was sprinkled on hot. The water caused the Tarvia coat to spread out uniformly over the surface and chilled it, which gave a uniform surface upon which to spread the concrete. The resurfacing was composed of 3 in. of 1:1½:2½ concrete. Marquette trap rock of sizes up to 1 in. and washed screen bank sand were used. Triangular mesh reinforcement No. 26 was used for reinforcing the surface. A Baker automatic finishing machine was used to finish the concrete. A more complete description of the construction of this road may be found in *Engineering Record* of Oct. 7, 1916, p. 434, as mentioned above.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Want Engineer as University Regent

The desirability of having an engineer on the board of regents of the University of Minnesota was discussed recently by the Minnesota Joint Engineering Board. The present personnel of the board includes four lawyers, of whom one is an ex-officio member, one doctor, two agriculturists, one banker, two educational men (ex-officio) and two business men. The work of the engineering department is one of the large activities of the university and is deemed worthy of a representative. The *Bulletin* of the Affiliated Engineering Societies of Minnesota points out that the welfare of the College of Enginering is largely dependent upon the personnel of the faculty and the budget allowance, both of which are controlled to a large degree by the regents. With an engineer on the board, it is argued, the engineering department would be understood more adequately, and its needs presented and protected more carefully than by men who are not engineers.

Minnesota Engineers Co-ordinate Society Activities

Evidently the Minnesota Joint Engineering Board is becoming a factor in society affairs in the Northwest, for membership in it is being sought by the Engineers' Club of Northern Minnesota, a live organization of 85 mining and civil engineers on the iron range, with headquarters at Virginia. This is the first organization with headquarters outside of the Twin Cities to propose joining the movement. Final acceptance by the board cannot be effected until November.

The germ of coördination is working in Duluth, too, as evidenced by the recent get-together banquet of 200 engineers representing sections of the four national societies. A committee was appointed to draw up a permanent plan of organization of an engineering club. Four plans are under consideration: (1) to have an all-inclusive organization for professional engineers, juniors and associates, with a different status for each; (2) an organization made up of members of the four nationals; (3) society members with a limited number of associates; (4) professional engineers only. Three elements were named as essential—professional, social and civic. It was suggested that affiliation be made with a civic body so that the entire community might be bettered.

British Municipal Engineers in Service

One-third of the membership of the Institution of Municipal and County Engineers, or 580 out of 1762, were reported, at the recent meeting of the Institution held in London, England, to be in active service. The loss of membership during the year, notwithstanding war conditions and the rivalry of the Institution of Municipal Engineers, was only seven.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Passaic Valley Sewer Contract Suit Settled by Agreement

Sir—Some time ago you referred at considerable length to the charges made by us in the complaint of O'Rourke Engineering Construction Co. vs. Passaic Valley Sewerage Commissioners, in which you went into the importance of engineers giving fair play to both parties to a contract. You also expressed a hope that this case would be tried, so as to determine whether the chief engineer had actually resorted to misrepresentation and fraud, as alleged.

Judgment for the amount due under the contract with interest was recently entered by consent of both parties. Our reasons are contained in the following letter addressed to us by Hughes, Rounds, Schurman & Dwight, New York City, and Griggs & Harding, Paterson, N. J.:

"Confirming our verbal advice to you that under the circumstances we would recommend the abandonment of all the counts in the above entitled action excepting that demanding judgment for $72,123.34, the amount admitted by the defendant to be due under your former contract, with interest, we beg to say:

"The situation as it existed on the eve of the trial of this action differed very materially from the situation existing at the time the action was commenced. The various counts in the complaint may be embraced in two groups:

"1. A claim for the loss of profits which it is estimated you would have made if the conditions had been as represented to you by the chief engineer of the defendant.

"2. Claims for actual losses sustained by reason of your having entered into the contract induced thereby by the representations alleged in the complaint to be false.

"With respect to the claim for loss of profits, we were compelled to advise you that after considering the matter carefully we were of the unanimous opinion that in an action based upon fraud and deceit you could not recover such prospective profits, but that as a matter of law your measure of damages was the actual loss which you had sustained. This rule of damages has been distinguished in some states and has been severely criticised by many text writers, including Sedgwick in his treatise on the law of damages, but in the jurisdiction in which the action was brought, i.e., the United States District Court for the District of New Jersey, we were of the opinion that you could not escape the rule as laid down in the case of Crater v. Binninger, 33 N. J. Law, 513 and the case of Smith v. Bolles, 132 U. S. 125. We feel that the rule is an unfair one and penalizes too lightly misrepresentations made to contractors, but we were and are obliged to advise you upon the law as defined by the highest courts in the jurisdiction in which the action was brought.

"We were of the opinion that we could not recover for loss of profits on account of breach of warranty due to the misrepresentation, inasmuch as the representations made by the engineer and contained in the plans as to the borings, in our view, would not be held to be a warranty, since both in the contract and in the plans which were made a part of the contract the language expressly provided that the representations were not to be warranties.

"With respect to the second class of claims, i.e., actual losses sustained by reason of your having entered into the contract, these were substantial at the time the suit was commenced, but during the progress of the suit the land and bay shafts with the buildings erected thereon were sold to the present contractor; part of the plant purchased for use on the work, which under ordinary circumstances would have been worth only a fraction of its cost, was sold for sums substantially in excess of the cost thereof, and plant remaining on hand, instead of being worth less, was, notwithstanding its use, worth if anything substantially in excess of the price at which it was taken upon the work. This was also true of materials and supplies. As a consequence, on the eve of the actual trial of the case, after minimizing the loss as you are compelled to do by law, the balance hardly exceeded if indeed it equaled the amount admitted to be due under your contract.

"A consideration which was of great weight in inducing us to advise you to withdraw the counts based upon fraud and deceit was that although we had the utmost confidence in your case, the entire question of damages would under these counts be a question for the jury and that, although the trial resulted in establishing your allegations of fraud, you might well have recovered damages for a sum less than $72,123.34, and interest. In that event you could not recover on the count for $72,123.34 and interest due under the contract, since you had chosen to try your case on the counts for fraud; so, though entirely successful, you might have been left with a verdict for a lesser amount than was due under the contract, owing to your losses having been so greatly reduced as above stated.

"Such a result would of course follow from the fact that under the rule for damages in case of fraud and deceit the plaintiff would get only the difference between what the work cost and what it has received, irrespective of whether that amount was found to be more or less than the sum due under the contract.

"Under these circumstances, we felt that it was our duty to advise the entry of judgment for the amount above stated."

Trusting that this will make our position clear as to why this suit was not tried, we remain,

O'ROURKE ENGINEERING CONSTRUCTION CO.,
JOHN F. O'ROURKE, President.

17 Battery Place, New York City.

[To present both sides of the case equally, *Engineering News-Record* asked the attorneys for the Passaic Valley Sewerage Commission to set forth the circumstances of the settlement. The reply of Riker & Riker, Newark, N. J., gives the statement which follows. —Editor.]

"The answer filed in the suit of the O'Rourke Engineering Construction Co. against the Passaic Valley

Sewerage Commissioners in the United States District Court for New Jersey admitted that there was due to the plaintiff the sum of $72,167.97, and stated that the defendant was always ready and willing to pay said amount upon the execution and delivery of a proper receipt and release. All other claims of the plaintiff involved in this suit were expressly denied. The sum named consisted of reserves accumulated on monthly payments in accordance with the terms of the contract to the amount of $50,000, and the final estimate of the chief engineer of $22,167.97. The judgment entered in settlement of the suit was for $72,167.97 with accrued interest thereon."

Virginia Has New Highway Bridge Contract

Sir: I am sending herewith a new payment clause which we propose to insert in our contracts for bridge work. It reads as follows:

Payments: Profit-or-loss sharing agreement:

1. All bidders shall name prices for the quantities of work and materials shown in their proposals. The cost of the work as determined by such prices and quantities will be herein referred to as the contractor's estimate.

2. The contractor shall be paid actual cost for the labor and material used in the execution of the work provided to be done under this contract, whether the cost be more or less than the contractor's estimate. The cost of work thus determined will herein be referred to as the labor and material cost.

3. The contractor will be paid a fee of 20 per cent. of the contractor's estimate for his actual supervision of the work, the use, repair and up-keep of all equipment, and all office and other expenses, commonly known as "over head expenses," except that should the labor and material cost be less than the contractor's estimate, the contractor's fee will be increased by the amount of one-half the difference, or should the labor and material cost be greater than the contractor's estimate the contractor's fee will be reduced by the amount of one-half the difference.

4. Should it become necessary to increase or diminish the quantities of work or materials, shown on the proposal, the contractor's estimate shall be revised, accordingly, at the unit prices given. The contractor's estimate so changed shall be known as the revised contractor's estimate, and shall be compared with the labor and material cost in computing differences, instead of the contractor's estimate as first determined.

5. The prices to be paid the contractor for labor, teams, materials, and other items, of every kind and description, furnished by him, shall be subject to the approval of the engineer.

6. The contractor shall furnish bills and payrolls upon forms prescribed by the party of the second part, for all items included in the labor and material cost. Bills shall be certified to by the seller and by the contractor. Payrolls shall be signed by the payee and certified to by the contractor.

All commissions, discounts and allowances of every kind and description shall be shown on the bills and shall accrue to the party of the second part.

7. Payments will be made promptly upon receipt of monthly statements of amounts due, with certified copies of payrolls and bills in duplicate, attached, reserving 15 per cent until 90 days after final completion.

WILLIAM R. GLIDDEN,
Bridge Engineer, Virginia State Highway Commission.
Richmond, Va.

Iowa Engineers Favor Legislation for Examination and Licensing

Sir—Of course we are all agreed that the fundamental object of license laws is to safeguard the public from reckless and incompetent engineering work. Supervision of engineering plans and construction would accomplish this. In Iowa, however, we have come to believe pretty strongly that safeguarding the public from poor engineering plans and construction can best be brought about by raising the standard of the profession itself, so that every authorized engineer will be capable of supervising his own work. To carry out any adequate supervision of engineering plans and construction by any other method would lead to endless ramifications of engineering service, which would be entirely impracticable in a state of this character, where so much engineering work is on a relatively small scale. The task of supervising the engineering plans would be very simple compared with any adequate supervision of construction. Furthermore, there would be no easy way of making the necessary modifications in plans as the construction work progressed.

It is true that in order to get a license law through the legislature, engineers now in active practice and measuring up to certain standards will have to be licensed without examination. This means that during our generation the benefits of the license law will not be so apparent as we should like. We have come to feel here in Iowa, however, that the engineering profession, if it is to be a profession, must look farther ahead than its own generation.

While in theory it is true that people and corporations which employ engineers have ample facilities for determining their qualifications, yet in practice here in Iowa we find very little understanding of how to determine an engineer's ability to perform a given task. In a surprisingly large number of cases the deciding element in the engagement of the engineer is his price. Competitive bidding for engineering services is becoming all too prevalent, with engineers from neighboring states, anxious to get a foothold in Iowa, apparently forgetting profits in the scramble to secure the job.

Naturally, a license law for engineers is not going to prove a cure-all for every malady afflicting the profession. Nevertheless, engineers in Iowa have come to believe rather unanimously that it is a step in the right direction, and an important one.

J. H. DUNLAP,
Secretary Iowa Engineering Society.
Iowa City, Iowa.

Population of National Capital Grows

Population in the District of Columbia increased by 38,198 in the year which ended Nov. 1, 1917, according to police censuses. The Federal census of 1910 showed a District population of 331,069. The police census of Nov. 1 showed 395,947.

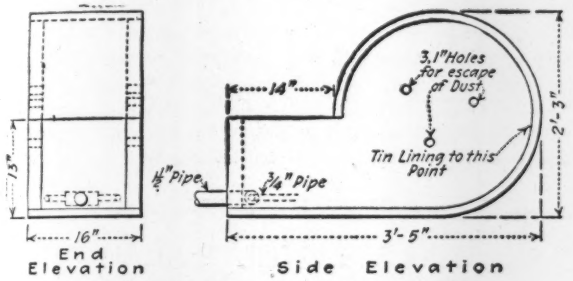
HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

"Washwoman" Cleans Twenty Cement Sacks in Three Minutes

By B. G. Best
Ironwood, Mich.

THE accompanying sketch shows a device used by the Oliver Iron Mining Co., at Ironwood, Mich., for cleaning used cement sacks. This cleaner, or "washwoman," as it is called, is a box, into which compressed air or steam is admitted through a 1½-in. pipe. The sides and one end of the box are made of 2-in. plank, and the bottom and curved part of 1-in lumber. As protection against the abrasive action of the sacks



CLEANS SACKS WITH AIR OR STEAM

and cement dust the bottom is lined with tin or sheet iron to the point indicated on the sketch. A 12 x 12-in. opening, for throwing in and removing the sacks, is left in the top at the rectangular end of the box. A few feet back from the cleaner a valve is placed in the air line, and just inside the box the 1½-in. pipe is connected by a reducing tee to two nozzles made of short lengths of ¾-in. pipe.

In cleaning a batch of sacks the man operating the cleaner first partially opens the valve in the air line and throws in five or six sacks, one at a time. As the air picks up these sacks and carries them into the enlarged part of the cleaner the operator opens the valve wide and throws in about fifteen more sacks in bundles of four or five. The air whirls the sacks around in the circular part of the cleaner, beating out the dust, which escapes through holes bored in the sides of the box and through the opening in the top. When very little dust escapes the air is shut off and the sacks are removed, practically as clean as before they were used. The dust remaining in the box is blown out by turning on the air for a moment.

With 100-lb. air pressure a batch of 20 sacks can be thrown in, cleaned and removed in 3 min., and one man operating the cleaner can keep a second man busy tying the sacks in bundles. Two men working in this way recently cleaned 3000 sacks in eight hours, at a cost of less than ½c. per sack, while cleaning by hand two good men will have all they can do to clean 200 sacks in the same time, and at a cost of 4c. each.

Significant Events in the Contracting Field

LAST week there was held at Atlantic City a convention of building interests. How inadequately contractors were represented in this gathering by comparison with manufacturers of materials is discussed editorially on another page of this issue.

In the pages of this journal for July 18 appeared two articles which find an echo on page 192 of the Letters to the Editor as well as in the editorial on page 158, and that indicate the possibility of better things in the handling of construction contracts.

Editorially this journal was called upon last week to review two situations of national import affecting the contractor—the heavy penalty imposed upon construction work already under way by the freight increase, and the indifference to the important needs of the contracting business manifest on the part of the Government.

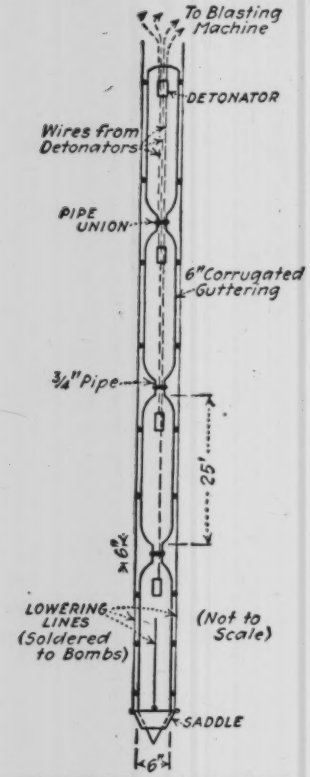
Had contractors a representative national organization, they would not rank below manufacturers at a gathering of those connected with the building industries. Could the strong and reputable contractors, who are in the great majority, get together, antiquated forms of construction contracts which impose unjust risks and restrictions on the contractor would vanish before the close of this war, never to return. Had the contractors of the country a strong central agency to represent them in Washington perhaps they would be relieved of unjust hardships imposed by the freight increase. At least, there is no doubt that they would take the place to which they are entitled in the councils of the Government. H. D. H.

Shoots Well With Single Hundred-Foot Bomb in Four Sections

FULL thickness of the water-bearing stratum in a deep well at the Chicago stockyards plant of Miller & Hart, Inc., was shot recently with a single hundred-foot bomb. The water-bearing sandstone was struck at 1440 ft. and penetrated at 1575 ft. To avoid the storage of explosives on the grounds, Miller & Hart, Inc., asked that all the shooting be made a single operation. The contractor, the Whitney Well Co., Chicago, Ill., met the rqeuirement by fabricating the giant bomb shown by the sketch.

Ordinary galvanized corrugated gutter pipe was used for the shells. This was soldered into 25-ft. sections

and the ends were closed by bending and soldering. To connect the sections ¾-in. pipe nipples were soldered into the closed ends and threaded so that they could be coupled together by pipe unions. Each case was loaded with 75% nitrogelatine, about 100 lb. to the case, and primed with a detonator consisting of a metal shell 2 in. by 1 ft. loaded with five No. 8 mercury caps and nitro-glycerine. Part of the work of closing the cases, placing nipples and threading the firing wires had to be done after each case was charged and of course involved very careful manipulation.



SHOOTS DEEP WELL WITH STRING OF BOMBS

After the four cases had been charged and connected up, the string was put into a lowering sling consisting of a metal saddle with four lowering cables of extra strong telegraph wire. To prevent slack and to tie the whole together the sling wires were soldered at intervals to the cases. When all was ready for shooting the string of cases was lowered by the derrick to position in the hole, the firing wires were connected to the blasting machine, and the whole 100-ft. charge was fired in one shot. It was entirely successful.

Daily Labor Report Carries Diary of Day's Happenings

BY JOHN T. SULLIVAN
Covington, Ky.

DAILY labor report sheets used on the East Side High School work at Cincinnati provided, besides the usual data on working force, wages, hours of work and distribution of time, a daily letter on important happenings concerning the work. One of these letters, as filled out on the job, is reproduced here. The plan does away largely with any need of a separate letter to the home office telling of happenings which the head officials need to know and for which ordinarily the regular report blank makes no provision. Risk of loss of separate letters and of misplacing them is eliminated, and the labor of checking and filing reports is lessened.

Daily labor report blanks were, on the work named, filled out by the timekeeper. The blank carried on its face, first, spaces for the names and the time-card numbers of the workmen, for the hours worked, the rate of pay and the total day's earnings. Then followed vertically ruled columns headed by letters and numerals, referring to the cost-distribution chart. All the different divisions and subdivisions of construction operations were thus listed, and each man's time was apportioned according to the tasks in which he had been engaged. These are the ordinary kinds of labor report blank data.

On the reverse, the blank carried at the top, as shown by the illustration, space for the daily letter. Below were similar spaces suitably headed for a daily material report, a daily cost report and a daily cement report. Each morning the report sheet for the previous day's operations was mailed to the home office. The report was a part of the cost-keeping system of Roos Bros., Cincinnati, contractors for the work named.

DATE June 22, 1917 **DAILY LETTER** CONTRACT NAME East Side High School (Unit Heat and Power House) NO. 292

REPORT—Progress of day's work - causes of delays - architect's instructions - changes in plans - materials needed in immediate future - delays in receiving materials previously ordered - full account of any accidents and all other remarks of importance.

Poured Cols. 1 To 36 Inclusive Order Third Floor Expect To Pour Balance Of Cols Under Third Floor Tomorrow Expect To Have Poured Entire Third Floor Inf Arts Beams And Slab By June 30, 1917

Several Minor Changes In The Boiler Foundation Have Been Requested By The Heating Contractor Third Mr Schoening, The Board Of Education's Supt. The Heating Contractor Will Furnish Within A Day Or So A Detailed Drawing Showing The Necessary Changes Work On These Foundations Was Stopped Today Pending Information Concerning The Above Mentioned Changes

Henry Westmeier #2342 Spring Street Mosher (10:20 AM) The Index Finger Of His Right Hand While Placing Steel For Beam #A Third Floor Inf Arts Westmeier's Finger Was Caught Between 2-1¼" Rods And Mashed Also Torn. Both The Upper Joint Of The Finger Was Dressed By The Timekeeper And Westmeier Returned To Work A Report Of The Accident Was Mailed To The Industrial Commission Of Ohio, Columbus, Ohio

LETTER ON REPORT SHEET TELLS OF DAILY PROGRESS ON WORK ON CINCINNATI HIGH SCHOOL

Wet Holes Successfully Exploded By Properly Connected Fuse

A SUCCESSFUL method of adjusting fuses, for exploding charges under water, was described by T. F. Price, of San Antonio, Tex., in a recent issue of *Coal Age*. The main feature consists in properly waterproofing the connection.

Referring to the illustration, A is a stick of dynamite, B is the detonator and C is a paraffine seal. In preparing this cartridge, the covering at the end of the stick of dynamite is first opened. Next, with a stick of suitable size, a hole is made in the explosive to a depth equal to at least twice the length of the detonator.

The fuse should be trimmed to make sure the end entering the cap is perfectly dry. After the fuse is inserted, carefully crimp the detonator. The paraffine is now applied, being pressed firmly around the cap and fuse. It can be brought to the proper consistency by kneading in the hand

The detonator may now be inserted in the cartridge,

FUSE AND DETONATOR SEALED WITH PARAFFINE AND INSERTED IN DYNAMITE

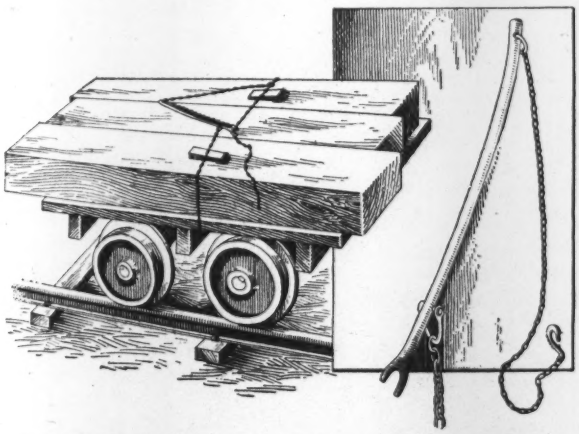
and the wrapping securely tied around the fuse. The other end of the fuse should be split, as shown at E, exposing the core. When the charge is properly placed and tamped, light this core and retire to a safe distance.

Mr. Price states that he has repeatedly used this method when firing charges submerged under 15 ft. of water and has had uniformly good results.

Lever and Chain Arrangement Binds Timber on Push Car

A CLAW lever and chains, to bind timbers securely on a push car, is shown in the illustration. The device is said to be very useful and works with either square or round material.

The details consist of a lever made of a slightly bent piece of 1-in. steel with a claw end, and two chains which are attached through two holes punched near the end of the rod. One hole is placed a fifth the length of the rod from the claw end, while the other is punched at the far end of the rod. The binding chain, which is long enough to pass around the car and its load, is attached to the rod by a clevis. To the other end is attached a chain the same length as the binding lever, and having a hook at the end to engage some link in the binding chain.



BENT LEVER ADJUSTED WITH CHAINS AND WEDGES

In use, the binding chain is passed under the car platform and over the load so that it can be gripped by the claw in the end of the lever. The free end of the lever is then pulled back as far as possible, and the fastening chain is hooked to a link in the binding chain.

When the truck is being used to haul plank lagging which is covered with ice, as is often the case in winter, extra grip can be produced by driving wedges between the chain and the outer rows of plank.

This device was described in a recent issue of *Engineering and Mining Journal.*

Trench Excavator Cuts Cost of Duct Line Between Tracks

CONSTRUCTION costs of an electric duct line between tracks on an Eastern railway line were substantially reduced last autumn by using a ladder-type trench excavator for removing the ballast and digging the trench. In round figures, the excavator work was 25 to 30% cheaper than hand labor, although, owing to loose rock in the trench, the excavator worked at considerable disadvantage. Machine work was also hindered by delays due to lack of men enough to keep the duct laying close up to the trenching.

Work with the excavator proceeded in two operations. Traveling between the trucks, the machine first removed the stone ballast down to the subgrade. The side conveyor delivered the ballast onto a screen installed under the conveyor. This screen dropped the fine material between the rails of one track and delivered the coarse stone on the outside shoulder of the same track. Canvas was laid between rails to catch the fine material. The second operation was the excavation of the 4½-ft. duct trench. To do this the trencher was shunted back and then run over the course a second time.

The duct was laid and the backfilling and reballasting were done by hand.

Specific figures gathered on the work are indicative of possibilities; they cannot be considered representative because the conditions mentioned greatly handicapped machine work. They were for:

Week Ending	Lin. Ft.	Cost	Est. Cost by Hand
Oct. 20	970	64c.	95c.
Nov. 1	1,713	36c.	63c.
Nov. 12	1,472	48c.	70c.
Nov. 20	1,517	49c.	64c.
Dec. 11	904	57c.	81c.

During the weeks which ended Nov. 27 and Dec. 4, 694 ft. and 869 ft., respectively, of duct were constructed by hand at an expense, respectively, of 81c. and 74c. per foot.

Air-Lift Pump Principle Improves Piledriving Jet

IN SINKING steel sheet piles at the Junction Dam, completed this year near Wellston, Mich., a combined air and water jet proved superior in effectiveness to a plain water jet. The piles formed a cutoff under a concrete core wall in an earth dike. They penetrated a number of veins of coarse gravel with thin layers of clay interspersed.

A water pressure of 200 lb. at the nozzle of the jet was had, and a 2-in. nozzle was employed. The air pipe, ½ to ¾ in. in diameter, was introduced into the top of the nozzle pipe and extended one-half to two-thirds its length. The combination jet was operated exactly as is usual in jetting piles, but its effectiveness in moving the gravel was markedly greater than that of the water jet alone.

The action appeared to be similar to that of the air-lift pump, and its efficiency was apparently due to the intermittent or hammer effect produced. The dam was built for the Consumers' Power Co. by the Fargo Engineering Co., Jackson, Mich.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Ohio Makes Special Appeal to Rail Administration

Asks Rebate on the Advance in Freight Rate for Road Contracts Let Prior to the Order

A hearing was given by the railroad administration to a delegation of Ohio officials and others, who made a special appeal that rebate be made on the advanced freight rate established by General Order No. 28, where such order affects road contracts executed prior to its issuance. The hearing was before M. B. Clagett of the administration, and data were presented by the Ohio officials, showing the hardship placed upon contractors by the order.

It was pointed out that the present laws in Ohio make it impossible for the state, counties or cities to assume any portion of the extra burden placed upon contractors by the advance in the freight rate, and that this would mean a gross loss of from $600,000 to $700,000 to the Ohio contractors. It was also stated that if this additional expense were placed upon them the contractors, already burdened by the excess cost of labor and materials, would be unable to continue with their work and would throw up their contracts, leaving road work in a chaotic condition.

The distinction between private and public contracts in Ohio was emphasized, and Mr. Clagett's attention was drawn to the fact that the method of letting and the form of contract are prescribed minutely by law and can only be altered by an act of the legislature.

As this is an uncertainty, it was the assertion of many of those appearing that a great many of the contractors would be compelled to refuse to go on with the work. It was also questioned whether the bonding companies could be held liable for the excess cost, and if the work had to be taken over by the state whether it would not cost from $2,000,000 to $3,000,000 more than the contract prices, to finish it.

At the completion of the hearing, Mr. Clagett advised the delegation that he would give careful consideration to their appeal and lay it before the Director General of Railroads. The following officials from Ohio were present: Joseph McGee, attorney general; Frank Davis, special counsel under the attorney general; Victor Donahey, state auditor; W. A. Stinchcomb, county surveyor of Cuyahoga County; W. A. Alsdorf, secretary Ohio Good Roads Federation; E. S. Humphreys of the State Highway Board; G. A. McCormick, of the Contractors' Association; Frederick Bramley, president of the Cleveland-Trinidad Paving Company.

Nitrate Plant Near Cincinnati

The $50,000,000 Government nitrate plant for the Cincinnati district will be erected at Broadwell, Ohio, on the Little Miami River, about 8 miles by air line and 11 miles by railroad from the center of Cincinnati. This plant was originally intended to be at Elizabethtown, Ohio, but the site has been changed, according to reports, because too much of the prospective trackage would be below maximum high water.

Emergency Fleet Corporation Has Requirement Section

Charles M. Schwab, director general of the Emergency Fleet Corporation, has created a new department called the Requirement Section, to which he has appointed as head George M. Brill, well known as a Chicago consulting mechanical engineer. In making announcement of the appointment, Mr. Schwab said: "It will be the purpose of this section to keep in touch with the shipyards and learn from them in a general way the amount of materials, supplies and equipment required for extension so that a proper schedule may be placed before the War Industries Board for survey and if necessary for allocation. I think you will appreciate that at this time, when the demand for many materials is so far in excess of the supply, it is most essential that a clearing house be provided so that the needs of different Government agencies may not conflict. The War Industries Board constitutes such a clearing house, and it is in my opinion a very essential instrument in the conduct of industry under present conditions."

Mr. Brill's main activity for the present will be directed toward the supply of steel to the various shipyards, many of which are not running at full capacity for lack of raw materials.

Opening New Sewage-Works at Albany Postponed

Owing to war conditions, the Board of Estimate and Apportionment of Albany, N. Y., has decided not to take steps to put into operation its new sewage-works, now almost completed. Difficulty has been experienced in maintaining a small number of men engaged on cleaning up the plant, writes Frank R. Lanagan, city engineer, thus suggesting still more difficulty in keeping up a full operating force. The possibility of a shortage of coal to operate the plant was also taken into consideration. It is believed that no harm will result if the sewage of Albany is discharged into the Hudson untreated for a while longer.

All-American Canal for Imperial Valley

Engineers Appointed to Make Studies for Proposed Route Render Preliminary Report

A progress report based on surveys of the route of the proposed All-American Canal for supplying Imperial Valley, California, has just been filed by the committee of engineers appointed to make preliminary studies of the project. Funds for this investigation were appropriated jointly by the Imperial Irrigation District and the United States Department of the Interior, $30,000 by the former and $15,000 by the latter. The board of engineers in charge of the work consists of C. E. Grunsky, appointed by the irrigation district; Dr. Elwood Mead, appointed by the University of California, and W. W. Schlecht, appointed by the Secretary of the Interior. The plan is to compile data concerning a canal which would have the advantages of being for its entire length on American territory and would increase the area that could be irrigated without pumping. Incidentally, such a canal would afford opportunity for considerable power development. A review of the main features of the committee's report follows:

The All-American Canal should be constructed, the report recommends, on the basis of irrigating 900,000 acres. It would be designed to carry 10,600 sec-ft. from the Laguna Dam to Siphon Drop and below the Siphon Drop 9000 sec.-ft. The canal would be about 15.5 ft. deep, nowhere exceeding 16 ft., the side slopes 1½:1. The velocity is to be 3.5 ft. per second when the canal is full and 2.5 ft. per second when half full. A velocity of 6 ft. per second is to be maintained in the concrete-lined sections and a velocity of 10 ft. per second in tunnel sections. All tunnels of considerable length will be constructed in duplicate some distance apart.

Until the main canal can be constructed around Pilot Knob, delivery would be made to the present canal below Hanlon Heading. Laguna Dam at the head of the canal would be raised from 1 to 2 ft. above its present crest, and the new canal intake would be provided with headgates of the flashboard type for a total length of 1200 to 1600 ft. The present desilting works at Laguna Dam will require enlargement and in addition the detention of silt would be provided for in two stretches of the canal, one occupying a mile of its length near the Laguna Dam and the other occupying a two-mile stretch near Hanlon Heading. Large sluice waste gates would be

provided above the Rockwood gate and at other places between that point and Laguna Dam. The main canal around Pilot Knob should be concreted as well as sections where the soil conditions are not satisfactory.

Final estimates should be confined to two routes, the report recommends, one following the boundary and the other near the present plank road. The location of the point of delivery to the Imperial Irrigation District should take the power possibilities into consideration, it is recommended. Two sites of 25- and 35-ft. drops are referred to in the report.

Local Housing Engineers and Architects Appointed

United States Housing Corporation Has a Number of Projects Under Design In Many Sections of Country

Following the formation of the United States Housing Corporation, which will design and build the numerous housing projects authorized under recent Congressional appropriations, and hitherto carried out by the bureau of industrial housing and transportation of the United States Department of Labor, announcement has been made of the local boards which will have charge of the design of various operations. These boards comprise an architect, a town planner and an engineer, who will have entire charge of the design of each housing development, working under general standards set up by the Washington office and producing final drawings which have to be approved by the Washington office. The list of cities, together with the names of the engineers, architects and town planners, is given herewith.

The only one of these developments which has been started is that at Charleston, W. Va., where a contract has been awarded for the construction of 85 houses to the Wills-Egelhof Co. of New York City.

In connection with the announcement of the formation of the housing corporation and the accompanying announcement that this corporation would have charge of all the Government housing developments, the Department of Labor has issued a statement which reads in part as follows: "A. Merritt Taylor, director of passenger transportation and housing, Emergency Fleet Corporation, called on O. F. Eidlitz, director of housing and transportation of the Department of Labor, in Washington, and in a protracted interview Messrs. Eidlitz and Taylor gave out the following general statement: 'We have adopted policies whereunder our respective activities will be carried on in complete coöperation and accord, to the end that duplication of effort will be avoided and maximum results will thereby be obtained for the Government at a minimum cost with maximum efficiency. We have a complete understanding whereby the activities of the United States Housing Corporation of the Department of Labor and the passenger transportation and housing division of the Emergency Fleet Corporation will at all times be fully informed with relation to respective projects, procedures and all matters relating thereto. All information of one department will be available for the use of the other at all times.'"

This statement would indicate that for the time being at least the two departments will be conducted as separate entities.

LOCAL PROJECT BOARDS FOR HOUSING CORPORATION'S DEVELOPMENTS

Project	Architect	Town Planner	Engineer
Alliance, Ohio	Walker & Weeks, 1900 Euclid Ave., Cleveland	Alling DeForest, 222 Sibley Block, Rochester, N. Y.	R. Winthrip Pratt Hippodrome Bldg. Cleveland
Bath, Maine	Parker, Thomas & Rice 110 State St., Boston	Loring Underwood, 15 Exchange St., Boston	Weston & Sampson, 14 Beacon St., Boston
Bethlehem, Pa.	Zantsinger, Borie & Medary, 112 So. 16th St., Philadelphia	T. W. Sears, 1424 Walnut St., Phila.	L. J. H. Grossart, Bethlehem Steel Co., Beth., Pa., and Alexander Potter, 50 Church St., N. Y.
Bridgeport, Conn.	R. C. Sturgis, 120 Boylston St., Boston	A. A. Shurtleff, 89 State St., Boston	Alfred Terry, 886 Main St., Bridgeport
Charleston, W. Va.	Godley, Haskel & Sedgewick, 244 Madison St., Philadelphia	Jas. L. Greenleaf, 1 Broadway, N. Y.	Jas. L. Greenleaf
Davenport & Bettendorf, Ia.	Temple & Burrows, 208 Main St., Davenport	Geo. E. Kessler, 423 Security Bldg., St. Louis	W. S. Shields, Hartford Bldg., Chicago
Erie, Pa.	Albert H. Spahr, Keystone Bldg., Pittsburgh	C. D. Lay, 15 E. 40th St., N. Y.	Chester & Fleming, Union Bank Bldg., Pittsburgh
Indian Head, Md.	Donn & Deming, 808 17th St., N. W., Washington, D. C.		
Mare Island (Vallejo), Cal.	Geo. W. Kelham, Sharon Bldg., San Francisco	P. R. Jones, Sharon Bldg., San Francisco	S. E. Kieffer, Mechanic Institute Bldg., San Fran.
Moline, Ill.	Carvin & Horn, Rock Island, Ill.	Geo. E. Kessler, 423 Security Bldg., St. Louis	W. S. Shields, Hartford Bldg., Chicago
E. Moline, Ill.	Carvin & Horn, Rock Island, Ill.	Geo. E. Kessler, 423 Security Bldg., St. Louis	W. S. Shields, Hartford Bldg., Chicago
New London, Conn.	Hoppin & Koem, 4 E. 43rd St., N. Y.		Tribus & Massa, 86 Warren St., N. Y.
Niagara Falls, N. Y.	Dean & Dean, 137 So. La Salle St., Chicago		
Norfolk & Portsmouth, Va.	Geo. B. Post & Sons, 101 Park Ave., N. Y.	Geo. B. Post & Sons, 101 Park Ave., N. Y.	Nicholas Hill, 100 William St., N.Y.
Norfolk & Portsmouth, Va. (Colored)	Rossel Edward Mitchell, Paul-Gale-Greenwood Bldg., Norfolk, Va.		
Philadelphia Navy Yard	Rankin, Kellogg & Crane, 1012 Walnut St., Phila.		
Puget Sound, Wash. (Bremerton)	A. H. Albertson, 725 Henry Bldg., Seattle, Wash.	E. T. Miache, 394 Jackson St., Portland, Ore.	Sawyer Bros., 410 Lindelle Bldg., Spokane, Wash. Geo. B. Sawyer, Sawyer Bros., Seattle, Wash.
Quincy, Mass.	J. E. McLaughlin, 88 Tremont St., Boston	H. J. Kellaway, 12 West St., Boston	Ernest W. Branch 21 Adams Blvd. Quincy
Rock Island, Ill.	Carvin & Horn, Rock Island, Ill.	Geo. E. Kessler, 423 Security Bldg., St. Louis	W. S. Shields, Hartford Bldg., Chicago
Washington Navy Yard	York & Sawyer, 50 E. 41st St., N. Y.		
Washington Navy Yard	James A. Wetmore, Acting Supervising Architect's Office, Washington, D. C.		
Washington Dormitories	Waddy B. Wood, 816 Connecticut Ave., Washington, D. C.		
Watertown, N. Y.	Davis, McGrath & Kiessling, 175 Fifth Ave., N. Y.	F. Vitale, 527 Fifth Ave., N. Y.	E. W. Sales, Watertown, N. Y.

Engineering Division of Employment Service Meets

A conference was called by the division of engineering, United States employment service of the Department of Labor, at the Engineering Club, Chicago, June 28, at which it was suggested by the director of the division that the first problem before it would be to make a survey and registration of all technical persons, and that advice was sought as to whether this could not best be accomplished in conjunction with the work of the National War Industries Commission. In making this statement A. H. Krom, director of the Division of Engineering, stated that such a survey would at once reveal the number, location and capacities of technical men employed, as well as the number and kind of technical men needed by employers engaged in essential war work.

The conference was opened by Dr. P. L Prentis, district superintendent, who explained briefly the functions of the United States Employment Service and cordially welcomed the assistance of those in attendance. William H. Finley was appointed chairman of the conference. Those in attendance were Dean John R. Allen, Dean Mortimer E. Cooley, W. W. DeBerard, C. E. Drayer, W. H. Finley, C. Francis Harding, A. H. Krom, Edgar S. Nethercutt, F. H. Newell, Edmund T. Perkins, J. A. Peterson, Dr. P. L. Prentis, Isham Randolph and George C. Dent.

Mr. Krom outlined the objects to be accomplished by the Division of Engineering, and stated that the engineers in attendance had been invited to assist in inaugurating the work and establishing standards for future guidance. He suggested that an engineering advisory board be named to act in a consulting capacity with the Division of Engineering.

A resolution was passed to the effect that an engineering advisory committee be named by Chairman Finley to act with the Division of Engineering in formulating and carrying forward its work. It was resolved that the desired register of all engineers be compiled in conjunction with the survey of the War Industries Commission, and that the classification be made by employing existing agencies represented by the various engineering and technical societies.

Record Regret at Loss by Marburg's Death

The board of directors of the Philadelphia Association of Members of the American Society of Civil Engineers passed a resolution at a special meeting held July 8, recording the deepest regret at the loss sustained by the death of Prof. Edgar Marburg. The resolution passed is as follows:

"Resolved, that the board of directors of the Philadelphia Association of Members of the American Society of Civil Engineers record with the deepest regret the loss which they and the engineering profession at large have sustained by the death of Edgar Marburg on June 27, 1918.

"As a member of the board and as vice-president since April, 1915, he was a most faithful worker and was always keenly alive to the best interests of the society and the association. His remarkable energy, enthusiasm and sincerity will always be remembered by those who were privileged to have been associated with him."

Atlanta Cannot Issue Water-Works and Other Bonds

Lack of affirmative votes to the extent of two-thirds of the total registration, as required by state law, defeated a proposed $800,000 bond issue at Atlanta, Ga., July 10. Of the sum named, $500,000 was to go for water-works improvements, including much-needed pumps; $75,000 for construction work at the garbage incinerator designed to make possible the utilization of waste steam by the generation of electricity, the latter to be turned over to the local light and railway company; $125,000 for motorizing the fire department; and $100,000 for housing the cyclorama of the battle of Atlanta. It is expected that the most urgent of the water needs will be taken care of by a special tax of $250,000, and a personal guarantee to the pump manufacturers to be given by the mayor, Asa G. Candler. There is a movement now on foot to obtain an amendment of the state law governing bond elections, so that it would require three-fourths of the votes cast, rather than two-thirds of the registered votes, in order to issue bonds. Should this become the law, an election will be held very soon to vote the necessary bonds.

Army Establishes Lumber Depot

Emergency demands for lumber for the various Army construction projects have become so great, and the cost of immediate purchasing in local yards has run so high, that the construction division of the Army has established a lumber depot at Gilmerton, Va. In this yard, which is situated on the Elizabeth River a few miles from Norfolk and on tidewater, a stock of from 12,000,000 to 15,000,000 ft. of lumber will be carried. It is estimated that the yearly turnover will amount to from 50,000,000 to 60,000,000 ft. The average increase in price for lumber bought from local yards for emergency work has run from $9 to $12 per 1000 feet. By purchasing in large quantities and charging only for yard maintenance, a greater part of this excess price is expected to be saved by the Government.

Injunction Against Cincinnati Garbage Works Refused

Holding that all known devices for the elimination of odors at the garbage works of the Union Reduction Co., Cincinnati, were being used, the Superior Court of that city recently refused to grant an injunction against the operation of the plant sought by property owners on the score of alleged nuisance.

Zoning Ordinance Adopted By Saint Louis

Five use, five height and four area zones have been established by the Board of Aldermen of St. Louis, in general accordance with a plan worked out after long study by the City Plan Commission under the direction of its engineer, Harland Bartholomew. The ordinance will take effect Aug. 15. There will be a first and a second residence, a commercial, an industrial and an unrestricted residence district; a 45-, a 60-, an 80-, a 120 and a 150-ft. building height district; and four districts in which varying restrictions will apply as to rear and side yards, inclosed and outer courts and percentage of lots which may be built upon. Those interested in the details of the zoning scheme may obtain copies of the ordinance and accompanying diagrams and colored maps, in the form of a 21 x 16-in. pamphlet, for $2.11, postpaid.

Short Line Railroads To Make United Protest

Representatives of the 1700 short-line railroads of the country which have been relinquished by the United States railroad administration will meet in Washington Aug. 7 to take steps to have the Director General of Railroads reconsider their status, according to arrangements made at a recent meeting presided over by F. M. Robinson, president of the American Short Line Railroad Association. About 25,000 miles of short lines, representing an aggregate investment of more than $2,000,000,000, are concerned in the recent order of the railroad administration turning the short lines back to the former management.

It has been asserted that the cases involving these lines were disposed of without adequate investigation.

Denver to Vote on Buying Out Water Company

Continuing the steps toward municipal ownership of water-works at Denver, noted in *Engineering News-Record* of July 18, p. 117, the people will vote Aug. 6 on a bond issue of $13,970,000 to pay for the property of the company and also on the election of a board of water commissioners.

New High Dam Site in California Favorably Considered

The Modesto Irrigation District and the Turlock Irrigation District in the San Joaquin Valley, California (81,183 and 176,000 acres, respectively) are making a joint investigation of the cost of additional storage capacity. The situation known as the Don Pedro dam site, six miles above La Grange dam, the present diversion works on the Tuolumne River, has been favorably considered. The height of a dam at this point could be about 290 ft. A. J. Wiley, consulting engineer of Boise, Idaho, was retained to report on the site. His preliminary report, made af-

ter detailed examination, was favorable, and the contract was awarded to the International Drill Co., Spokane, Wash., for making foundation test borings. Thus far, after five holes have been put down to a 50-ft. depth, the results are reported to be entirely satisfactory. P. F. Jones is chief engineer of the Modesto Irrigation District, and R. V. Meikle is chief engineer of the Turlock District.

Government Takes Over Cape Cod Canal After U-Boat Attack

Following the U-boat attack on a coal-barge tow off Cape Cod on July 21, President Wilson on July 23 issued a proclamation assuming control of the Cape Cod Canal and directing the railroad administration to operate it after July 25. The railroad administration has announced that dredging of the waterway to a depth of 25 ft. will be begun immediately, that water-borne coal for New England will be routed through the canal and that the various New England steamship lines hitherto skirting the cape will use the shorter route through the canal.

French Impressed by Initiative of American Engineer Officers

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PARIS, July 12.—The French people are showing increasing admiration of the businesslike manner in which Americans are handling the work of war here, and scarcely a day passes without significant stories being published demonstrating how the transatlantic ally insists on overcoming often absurd administrative fetters which hamper rapid progress in this country.

The *Petit Journal* recounts today how an American engineer captain surprised officials of the Est Railroad Co. by accomplishing in five or six hours what he had been assured would involve a delay of a fortnight. Near Gondrecourt Station was a huge collection of railroad ties condemned to be cut up for firewood. The American engineer officer cast a longing eye on these ties for use on the narrow-gage switchroad he wished to build close by.

On offering to purchase the ties the officer was told by the railway man in charge that sale was impossible, as the ties were condemned for firewood.

"Then sell them to me for firewood," said the American.

"Not possible," was the reply.

Eventually the official explained that the only thing to do was to obtain permission from the head offices in Paris, which would take at least a fortnight.

"When does the first express leave for Paris?" asked the officer.

"This evening," was the reply.

"Thanks," said the officer. "Good morning."

In the morning a gang of husky "Sammies" started loading up ties.

"Here is the permit," the officer told the railroad officials, showing a sheet of paper. "We shall start our narrow-gage road tomorrow morning."

Mississippi and Warrior River Traffic Taken Over

Further extension of the Federal control of the inland waterways took place July 11, when the Director General of Railroads issued a general order, effective that date, appointing M. J. Sanders, Federal manager of Mississippi and Warrior waterways for the United States railroad administration, with headquarters at New Orleans, La. The order states that Mr. Sanders is to have charge of the construction and acquisition of equipment for use upon the Mississippi River between St. Louis and New Orleans and for use upon the Warrior River between the Alabama coal fields and Mobile, and the connection therewith for use upon Mississippi Sound and connecting waters between Mobile and New Orleans, and will operate such equipment for the Director General of Railroads upon all such waters. Mr. Sanders is empowered to enter into contracts, either in his own name as Federal manager or in the name of the Director General of Railways, for the construction, acquisition or chartering of equipment, for the purchase of the supplies needed in the operation of the river, and for the transportation and traffic upon all the waters under his charge.

Mr. Sanders has been manager of the Leyland Steamship Line for the ports of New Orleans, Mobile and Pensacola for the past thirty years. In March last he became a member of the inland waterways committee of the United States railroad administration. He has long been an advocate of waterway transportation in the district over which he is to assume control.

Another Section of the New York Subway Opened for Traffic

A special train carrying city officials and invited guests was run over the Lexington Ave. line of the New York subway system on Wednesday, July 17, to celebrate its opening for public traffic. The section opened extends from the diagonal station (at the Grand Central Terminal) up Lexington and Jerome Aves. to 167th St. Only local trains will be run at present over this line; but eventually it will form the main east side line and trains will run over it as far north as Woodlawn.

Lincoln Highway Cutoff to Cross Desert in Utah

A short cut in the Lincoln Highway route across Utah, shortening the distance by 50 miles, will include the construction of a 6-mile highway along the line of the present trail through Johnson Pass, and a 17½-mile stretch of 18-ft. gravel road across the Salt Lake Desert. The present winding route from Salt Lake City to Ibapah skirts both the range and the desert, and has a length of 192 miles. The new direct route will be only 142 miles between the same points, cutting across the range and the desert.

The mountain section will start from the end of the present state highway at Clover, and will cost about $25,000, while the desert section will cost about $100,000. For the furtherance of this project, the Lincoln Highway Association is reported to have raised a fund of $125,000, of which the association pledged $25,000, The Goodyear Tire & Rubber Co. $75,000 and F. A. Seiberling, president of the association, $25,000. The association will also guarantee $5000 per year for five years for maintenance, after which the work will be maintained by the State Highway Department.

The new road is to be built by the state, and work has already begun under the direction of G. F. McGonagle, state engineer, and Ira R. Browning, state highway engineer. Convict labor is being employed, and the employment of German prisoners from Fort Douglas is proposed. The work will be finished before winter, it is expected.

Langfitt Now Pershing's Chief of Engineers

According to dispatches from the American Army in France, Maj. Gen. W. C. Langfitt has been made chief engineer of the American Expeditionary Forces. Gen. Langfitt was a colonel of engineers when war was declared and went over in command of one of the early engineer regiments. He has since had two promotions to his present rank.

Successor to Engineer Health Officer Wanted

Owing to the resignation of C. H. Wells as health officer of Montclair, N. J., on July 23, noted on p. 201, a vacancy exists in a suburb of New York City which for 22 years has employed a sanitary engineer as health officer and has retained the incumbents until they resigned to enter larger fields of usefulness. The position was first filled by Theodore Horton, now chief engineer of the New York State Department of Health. Other sanitarians who began their professional work in Montclair are Marshall O. Leighton, Prof. C.-E. A. Winslow and Horatio N. Parker. Applicants for appointment should address Secretary, Board of Health, Montclair, N. J. Full particulars as to education, experience and salary are desired in the first communication, as the board intends to fill the vacancy within a week or ten days.

Chinese Will Build United States Ships

Chairman E. N. Hurley of the United States Shipping Board has announced that contract has been closed with the Kiang-Nan Dock & Engineering Works, Shanghai, China, for the construction of four steel ships of 10,000 tons deadweight carrying capacity. The contract further carries the option for the building of eight more vessels of similar tonnage at the yard. The yard is under the exclusive control of the Chinese Board of Navy, which has assured

the Shipping Board that it will be able to furnish all labor and materials for the building of the ships, with the exception of less than 40,000 tons of steel plates, which must come from this country. Engines and other equipment for the entire 120,000 tons of vessels will be obtained in China.

Eastern Ontario Good Roads Association Formed

At a meeting of about 300 good roads men of eastern Ontario, held July 8 at Ottawa, a permanent association was formed, to be known as the Eastern Ontario Good Roads Association. The object of the association was declared to be the promotion of highway improvements, and the end in view is a continuous system of improved highways throughout the eastern part of the province.

Alderman William Findlay, of Ottawa, called the meeting to order, and after several speeches, explaining the purpose of the new organization, the following officers were elected:

President, Alderman William Findlay, Ottawa; vice-presidents, John Brennan, Armprior; W. B. Barker, Portland, and Dr. Smith, Hawkesburg. W. Y. Dennison, Ottawa, was elected secretary and treasurer.

A definite program of highways to be constructed was drawn up for presentation to the provincial Government, and arrangements were made for sending a representative committee to Toronto, to urge the building of three highways, one from Ottawa to Petawawa Camp, one from Ottawa to Point Fortune, Quebec, and one from Ottawa to Morrisburg. A number of prominent members of the association visited Kingston, Ont., in company with the Hon. G. S. Henry, minister of agriculture, and W. A. McLean, deputy minister of public works, and inspected several roads in the county of Frontenac. Mr. McLean announced that the Government would take over for maintenance purposes at once, and for construction after the war, nearly all of the road between Napanee and Brockville. Later the stretch between Prescott and Ottawa will be included in the system. He stated that the Government good roads policy would aid much in solving the problem of finding work for the returned soldiers.

ENGINEERING SOCIETIES

The Engineers' Society of St. Paul made a trip of inspection of state roads, via automobiles, as a feature of the meeting of July 20. The route was through Shakopee, Henderson, Mankato, Faribault, and Farmington, returning to St. Paul.

The Washington State Good Roads' Association, Spokane, Wash., will hold its nineteenth annual convention in Pasco, Wash., Nov. 14-15, according to announcement of the executive committee. Horatio S. Earle, Detroit, Mich., will be included in the list of speakers.

The Saginaw Engineering Society Saginaw, Mich., elected the following officers at its recent meeting: President, R. W. Roberts; vice-president, W. L. Whitney; executive committee, J. H. Stewart and John P. Wood, with the officers.

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Sept. 2, Denver, and Sept. 3, Colorado Springs, Col.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS; Pittsburgh; Sept. 9-13, Baltimore.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS; 304 East Walnut St., Bloomington, Ill.; Oct. 2-4, Buffalo, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Boston.

PERSONAL NOTES

L. G. CURTIS, who was recently appointed assistant chief engineer of the Baltimore & Ohio R.R., as mentioned in *Engineering News-Record* of May 30, p. 1066, has now been appointed chief engineer of the western lines of the Baltimore & Ohio system, with headquarters at Cincinnati. With the exception of one year shortly after his graduation from Ohio State University in 1899, Mr. Curtis has been continuously in the service of the Baltimore & Ohio system. Beginning at Zanesville, Ohio, he was transferred to Garrett, Ind., in 1901, as assistant division engineer of the Chicago division. Two years later he was promoted to division engineer and his headquarters were transferred to Chicago. When the Baltimore & Ohio acquired the terminal and trackage of the Chicago Terminal Transfer Co., Mr. Curtis was put in charge of its engineering work, first as engineer maintenance of way and later as district engineer. His jurisdiction also extended eastward over a part of the Baltimore & Ohio proper.

J. M. BRAXTON has been appointed United States district engineer, Jacksonville, Fla., succeeding J. W. Sackett, drowned recently in the wreck of the United States dredge "Florida" off the Florida coast. Mr. Braxton has been connected with the United States Engineering Department since 1897, previous to which time he was engaged in railroad work. In 1900 Mr. Braxton was placed in charge of the United States Engineer Office in Key West, Fla., having charge of the construction of batteries, the making of surveys for river and harbor work, jetty construction, and various other survey work until 1909, when he was transferred to Jacksonville to undertake the general supervision of the fortification works at Key West and Tampa, as well as surveys for the trans-Florida Canal and the intercoastal waterway from Fernandina to Key West. Mr. Braxton designed and built the first of the Government's all-concrete docks at Key West.

J. B. CAROTHERS has been appointed assistant to the Federal manager, Baltimore & Ohio R.R., with headquarters at Cincinnati. Mr. Carothers entered the engineering department of the Baltimore & Ohio system in 1895 as assistant engineer at Cincinnati, becoming division engineer in the next year. In 1904 he was made division superintendent of the Ohio division at Chillicothe, Ohio, being transferred in 1905 to the superintendency of the Indiana division at Washington, Ind. In this position he remained until 1910, when he was promoted to chief engineer maintenance of way of the Baltimore & Ohio Southwestern R.R. He later became superintendent of the Philadelphia division, after which he was transferred to special engineering work on the staff of the chief engineer.

PROF. FREDERIC BASS, chairman of the department of civil engineering, University of Minnesota, has been appointed acting secretary of the American Association of Engineers. Professor Bass has been a member of the faculty of the University of Minnesota for 17 years, going there almost immediately after his graduation from the Massachusetts Institute of Technology. He will return to the university about Sept. 1, by which time, it is expected, a permanent secretary will have been appointed for the association.

W. A. BALDWIN, transportation assistant, Erie R.R., has been appointed general manager, with headquarters at New York City. After his graduation from Cornell University in 1896, Mr. Baldwin entered railway service in the engineering department of the Erie R.R., first as a rodman and later as assistant engineer. In 1902 and 1903 he was train master, and from that time until 1909, division engineer, becoming superintendent of the Chicago & Lima division in 1910. Mr. Baldwin's entire service has been with the Erie.

ARTHUR B. CALDWELL, train master of the Erie R.R. at Buffalo, and previously division engineer at Salamanca, N. Y., has been appointed superintendent of the Rochester division with headquarters at Rochester, N. Y. At the time of Mr. Caldwell's appointment as division engineer for the Erie, he was division engineer of

the New York, Susquehanna & Western R.R., with headquarters at Jersey City, N. J.

SYDNEY B. WILLIAMSON, construction engineer for the South American mining projects of Guggenheim Bros., has been commissioned lieutenant-colonel, 55th Railway Construction Engineers, United States Corps of Engineers. In the early part of 1916, Mr. Williamson resigned from the office of chief of construction of the United States Reclamation Service to become connected with the Guggenheim interests. Previous to his connection with the Reclamation Service he was construction engineer with J. G. White & Co., Ltd., London, England, and previous to that was division engineer for the Pacific division of the Panama Canal. He was graduated from the Virginia Military Institute in 1884 and, after somewhat more than a year as instructor of mathematics at Kings Mountain Military School, was engaged in railroad work until 1890, when he entered private practice at Montgomery, Ala. In 1892 he entered the service of the Government on Tennessee River improvement work and remained in that service, with the exception of a short period in Porto Rico as captain of engineers during the Spanish-American War, until 1904, when he went to New York City as designing engineer for the Expanded Metal & Engineering Co. In 1907 he went to the Panama Canal as engineer in charge of the Pacific locks, and, in 1908, was appointed division engineer of the Pacific division. He resigned from the Canal Commission service in the latter part of 1912 and went with J. G. White & Co., Ltd. He was appointed chief of construction in the Reclamation Service in December, 1914.

HARRY O. COLE, assistant construction engineer for the South American mining projects of Guggenheim Bros., has been appointed construction engineer, succeeding Sydney B. Williamson, who has received a commission in the United States Corps of Engineers as lieutenant-colonel, as noted above. Mr. Cole became associated with the Guggenheim interests during 1916 as assistant engineer in charge of the construction department in the development of the Chilo Exploration Co. and the Braden Copper Co.'s mines at Chilo, involving an expenditure of some $35,000,000. Mr. Cole is a graduate of West Virginia University, class of 1898. For three years after graduation he was employed as draftsman by several bridge and steel companies, after which he was for four years assistant engineer in the office of Virgil G. Bogue, consulting engineer, New York City. In 1907 he became bridge engineer of the Oaxaca & Pacific Ry. in Mexico, and subsequently served on the investigating committee of the Queensborough Bridge in New York City. In 1908 he was engaged by the Isthmian Canal Commission as assistant engineer of the old Pacific division, later becoming resident engineer of the fifth division of the Panama Canal, from which position he resigned in 1914. From this time and until his association with the Guggenheim interests he was a member of the engineering and contracting firm of Cole Bros., Inc., Baltimore.

PROF. OLIN B. LANDRETH of the department of civil and structural engineering, Union University, Schenectady, N. Y., has been appointed mechanical engineer in the production bureau of the Ordnance Department, Washington, D. C. Professor Landreth has been granted an extension of his leave of absence from Union University to undertake this work.

CHARLES BROSSMAN, consulting engineer, Indianapolis, and Frank C. Wagner, professor of mechanical engineering at Rose Polytechnic Institute, Terre Haute, Ind., have been appointed by the United States fuel administration to take charge of special fuel conservation activities in Indiana industries, as announced by Horace H. Herr, director of conservation of the state fuel administration.

F. C. WILLIAMS, assistant engineer, Miami Conservancy District, Dayton, Ohio, has been transferred to Hamilton as superintendent in charge of the construction of sewers and drainage work.

R. D. GOODRICH, city engineer of Lansing, Mich., has resigned to become a member of the staff of American engineers who are shortly to undertake the making of surveys, plans and estimates for rebuilding a portion of the Grand Canal of China, some 200 miles in length, according to present plans. Mr. Goodrich will sail from San Francisco July 27.

W. S. GEARHART, for the past nine years state highway engineer of Kansas, has received a leave of absence from the state highway commission to become a captain in the Engineer Reserve Corps. Mr. Gearhart has been assigned to duty at Camp Lee, Virginia.

WILLIAM HALL WALLACE, recently construction engineer for the Davison Chemical Co., Baltimore, Md., has received a commission as first lieutenant in the Engineer Reserve Corps and is now at Camp Lee, Virginia.

GEORGE H. RUHLING has resigned as office engineer in the office of the city engineer, Flint, Mich., to become resident engineer for the city of Highland Park, Mich., in connection with the construction of the new filtration plant for that city.

JOHN NEVINS, Seattle, has been appointed structural and mechanical engineer for the Government housing project at the Puget Sound Navy Yard, Bremerton, Wash.

CHESTER H. WELLS, health officer of Montclair, N. J., for the past 13 years, has been chosen by the Delaware State Council of National Defence to serve as state health commissioner. He will assume his new duties Aug. 15. Mr. Wells is a graduate in sanitary engineering from the Massachusetts Institute of Technology. For a time between his graduation and going to Montclair he was with the Bureau of Filtration, Philadelphia, while the filter plants there were under construction. He is secretary of the American Public Administration Association and a member of the National Commission on Milk Standards.

R. H. OBER, consulting engineer, Seattle, and formerly superintendent of buildings for that city, has entered Y. M. C. A. service as an ambulance driver.

ARTHUR H. YOUNG, director of the American Museum of Safety, has resigned to become head of the department of employee relations of the International Harvester Co. Since Mr. Young was recently elected to the vice-presidency of the Museum, succeeding the late Dr. Frederick R. Hutton, whose death was noted in *Engineering News-Record* of May 16, p. 977, he will continue to be connected with the affairs of the museum, although giving up the actual direction of its work. Recently the museum awarded to him the Louis Livingston Seaman medal, in recognition of his work.

R. M. LITTLE of the board of trustees of the American Museum of Safety, has become director of the museum, succeeding Arthur H. Young, resigned, as noted above.

W. J. ELMENDORF, of Campbell, Wells & Elmendorf, mining engineers, Seattle, has been appointed consulting engineer for the United States Bureau of Mines, assigned to the territory of the Northwest.

E. T. BOWER, resident engineer of the Alaskan R.R. at Turnagain Arm, Alaska, will become assistant engineer in the maintenance of way department, succeeding E. O. Archibald, resigned.

OBITUARY

EDWARD S. MELOY, for 32 years on the engineering staff of the Chicago, Milwaukee & St. Paul Ry., died in Chicago July 8. He entered the service in 1886 as a draftsman and four years later became assistant engineer. At the time of his death he was assistant engineer in charge of bridge inspection and construction.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Peat Industry Increased 420% in Ten Years

Its Use for Fuel and for Fertilizer Will Hasten the Development of Large Eastern Deposits

The peat industry in the United States in the past 10 years has increased 420%, according to statistics compiled by C. C. Osbon, of the United States Geological Survey, Department of the Interior. Although as yet a comparatively small business, a like increase in the next 10 years will make it a $3,000,000 industry. Fifteen to twenty million tons are consumed in Europe annually for generation of heat and power.

The average price received for peat in 1917 at the point of consumption was a little more than $7.29 per ton, and the gross market value of the output at present is $709,900; by proper productive methods the price can be reduced to $2.50 per ton. There were but 18 producing plants in the United States in 1917, distributed from New York to California, but mostly on the Atlantic Coast and in the Middle West, and all the producers reported that the demand for peat exceeded the supply.

Deposits that can be used for fuel are found throughout Minnesota, Wisconsin, Michigan, New York and the New England states, and in the northern parts of Iowa, Illinois, Indiana, Ohio, Pennsylvania and New Jersey; also on the Atlantic Coast from New Jersey to southern Florida and westward along the Gulf coast to the Mexican boundary.

Owing to the fact, however, that it is necessary to subject it to considerable drying, its substitution as a fuel, will be purely local, but the large deposits in New York State and Pennsylvania on the middle Atlantic and the Gulf coasts, make it a potential source of fuel for future use if properly mined, as pointed out by Mr. Obson.

Peat or muck consists of partly decayed vegetable remains that contain enough carbon to ignite and burn freely when dry, and ranges from the imperfectly decayed kind, of a light yellow color, to the thoroughly disintegrated jet black type. In an undrained swamp it contains about 90% of water, which must be reduced to 30% before it can be used for fuel, so that the season for drying must be commenced as early as Apr. 15 and ends in September, except in the Southern region where it is somewhat longer. It is evident, therefore, that the season for cutting and drying peat is too far gone to afford any great relief in the fuel situation this season, especially since no artificial drying process of commercial value has been developed. The value of a deposit of peat as a source of fuel is dependent on many factors, most important of which are degree of decomposition, heating value and ash content.

This material has frequently been used as a source of charcoal and coke, of various byproducts from coke retorts, such as those obtained from the distillation of wood, and of fuel and illuminating gas, as well as in making paper, substitutes for wood and packing material. The prospective value of the peat deposits of the country as a source of these products is much larger than their value as a source of fuel.

Analyses of the peats of the United States show that they contain from 70 to 85% of combined nitrogen, a proportion that in some varieties amounts to more than 2% of their dry weight. This may be recovered in the form of ammonium sulphate, one of the valuable ingredients of commercial fertilizer. It has not yet been proved that the extraction of nitrogen from peat can be made on a large scale, but in view of the difficulty the United States is experiencing in obtaining salts of this nature for agriculture and the explosives industries, the process invites larger experiments, says Mr. Osborn.

Fuel Administration Needs Combustion Engineers

The bureau of oil conservation, oil division, United States fuel administration, is anxious to obtain a combustion engineer for each of the following districts, who will inspect all plants within his district using fuel oil and natural gas: Boston, Providence, New York City, Philadelphia, Pittsburgh, Buffalo, Detroit, Chicago, Minneapolis, Tulsa, Okla., New Orleans and San Francisco.

Only men who have had experience in fuel oil and natural gas combustion are desired, and it is asked that those who are able will volunteer their services. The administration, however, is prepared to pay a reasonable compensation to those who are unable to afford volunteering their services.

Large Tin Plate Mills To Be Built by Steel Corporation

A $10,000,000 extension to the Gary, Ind., plant of the United States Steel Corporation will be built by the American Tin Plate Co., a subsidiary of the Steel Corporation.

Tin production has been the subject of considerable study and discussion between the United States officials and tin plate producers the past few months, the Government demands becoming so heavy as to make necessary this large extension.

General Staff Centralizes All War Department Purchases

All future purchases of the War Department will be centralized in a division of the General Staff of the Army. The new system has recently been perfected which provides for a review of every contract by boards of control, the centralizing of purchases, the standardization of contract clauses, a daily fiscal survey and provisions for public information on War Department needs.

This action will eliminate competition among bureaus and will place technical purchases in the hands of experts in each commodity, reduce the personnel engaged in specialized purchases, centralize purchasing methods; all this, it is expected, will result in a large saving to the Government. As an illustration of the savings that will be effected in salaries and time, the purchase of leather goods for the Army will be under one bureau instead of five, as formerly, and the same will hold true for hardware and other materials.

Each bureau of the War Department will have a board of award, which will pass on all contracts and will be composed of officers other than those who have conducted the actual negotiations. One officer from each of the bureau boards will sit in a superior board of awards of the General Staff and pass on all questions of general policy before they are presented to the Secretary of War for decision. This superior board will receive the instructions of the Secretary of War concerning such policies and thus make uniform throughout the War Department the execution of policies affected. A report is to be made by an investigation committee appointed several weeks ago, composed of officers and civilians who have made a thorough study of contract clauses and policies in all the agencies of the War Department. It will endeavor to prescribe the form of contract clauses that would best serve the interests of the Government and will have for immediate use well considered and practical forms for every conceivable circumstance of purchase. Another activity of this division will be to make an analysis and tabulation of the various Congressional appropriations from day to day and an accounting of expenditures, so that the Secretary of War may know each day the precise status of each appropriation at the close of the preceding day's business.

The commandeering of work, requisitioning and issuing of compulsory orders for the whole war machine has also been centralized under the General Staff.

Government Orders Large Number of Standard Auto Trucks

The War Department has ordered over 18,000 standard three-ton trucks, 3000 of which have already been delivered. The Quartermaster Corps has been working for a number of months on a standard truck, and this last order indicates the success reached in that this truck, known as the "Class B standardized truck," was selected after rigid tests in competition with the trucks offered by different manufacturers.

Truck manufacturers opposed the adoption of a standardized machine, but the War Department maintained that it was absolutely essential to standardize as much war material as possible, so that the matter of repairs and spare parts could be handled in the most efficient manner.

Will Withhold Priorities to Check Competition of Labor

The War Industries Board has passed a resolution in which it is stated that priority assistance will be withheld from employers who persist in pursuing peace-time methods in the procurement of labor. The withdrawal of labor from war industries on account of this competition is strongly disapproved, and the board will take this action through its priorities division.

A copy of the resolution has been certified to the chairman of the War Labor Policies Board and to all other Governmental agencies employing or dealing with labor, and is receiving general publicity.

Large Shipment of Motor Trucks for United States Engineers

The accompanying illustration shows a fleet of war trucks lined up for inspection before shipment to France. These, and several thousand others now in the service of the United States Engineers, are to be engaged in construction work, backing up the American Army in France.

They are Mack war trucks, handled by the International Motor Co., New York.

Summer Meeting of Industrial Traffic League

A summer meeting of the National Industrial Traffic League will be held at the Hotel Statler, Cleveland, Ohio, Thursday and Friday, Aug. 15-16. A program of subjects, which, according to the notice, will be of considerable importance, will be published and distributed about Aug. 1. Every member is urged to arrange his appointments so as to be able to attend this meeting, and the league invites traffic representatives of organizations or individual concerns not members of the league. The secretary requests a list of such names and of prospective members to be sent to E. F. Lacey, assistant secretary, 413 Tacoma Bldg., Chicago.

Object to Blacksmithing the Bumps Off Reinforcement

Advocates of the deformed reinforcing bar have ample field for publicity efforts among the members of the firm who recently addressed to the Truscon Steel Co. the following letter:

"Gentlemen—We received order of steel reinforcing bars. We find you sent 70 pieces ½-in. x 32-ft. round rib straight bars. We wanted these to be smooth round bars so they would, after being coated, slip in concrete as it expanded or contracted. Please ship 70 pieces of ½-in. x 32 ft. of smooth round bars and advice us where to return the above rib bars.

"We hope you will arrange to exchange as we do not wish to blacksmith out the ribs to smooth out bars."

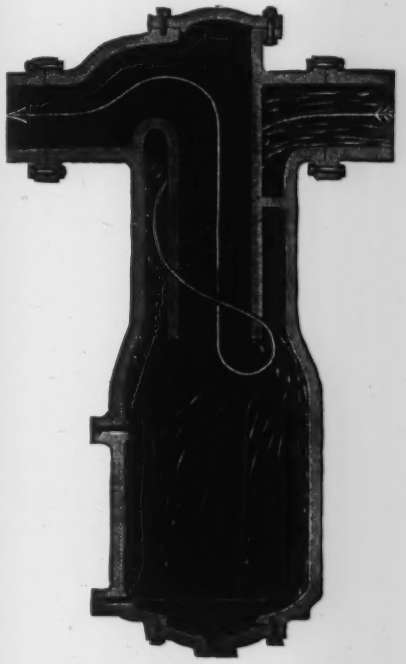
Freight Rates Modified for Oil in Carload Lots

A modification of the increase in freight rates as established by General Order No. 28 on petroleum oils in carload lots, was authorized by the director of traffic of the United States railroad administration. The tariffs will be filed at the earliest possible date and will be effective on one day's notice, making the increased rates uniformly 4½c. higher than the rates in effect on May 25. However, the increased class rates for the ratings provided in the official Western and Southern classifications will not be exceeded.

TWO HUNDRED MOTOR TRUCKS FOR EXPORT AWAITING INSPECTION

Air Separator or Water Trap for Compressed Air Lines

The Stratton air separator, shown in the accompanying illustration, is a device for removing water from compressed air by the use of centrifugal force. It has been designed to eliminate trouble arising from water in the cylinders of compressed air tools, which not only reduces the efficiency of the tool but sooner or later results in damage. As the water-laden air passes



SEPARATOR FOR COMPRESSED AIR

through the device the water is thrown to the sides of the cylinder by centrifugal force and passes downward to the bottom of the cylinder, where it may be properly drained. Since the action is mechanical, it is essential that the air shall be sufficiently cool before entering the separator to condense as much of the water vapor as possible.

The separator is constructed of cast iron suitable for a working air pressure not in excess of 160 lb. per square inch, has no internal movable parts and will operate indefinitely with a minimum of attention. It is manufactured by the Griscom-Russell Co., 90 West St., New York, and is described in their latest Bulletin, No. 1109-C.

Government Controls Chlorine

Control of the chlorine industry of the United States was assumed by the War Industries Board on July 16, with the approval of President Wilson. For the present nothing more will be done by the Government than to regulate the distribution of the product under the direction of H. G. Carrell, chief of the board's alkali and chlorine section.

Available Steel Supply In England Increasing

The available steel supply in England is increasing on account of the diminishing exports to Russia and the increased capacity brought about to meet the enormous demand for war materials. The war demand is being adequately met with something left over to meet the requirements of civil trade. There is a more regular delivery of steel of all descriptions, and restrictions that have been in force for several months are now being removed. Local foundries are dispatching heavy rolling machinery to all parts of the country and large extensions of steel rolling plant are still being made in the iron and steel districts, which will further increase the current output. The position of the sheet makers has improved; black painted sheets for shelters for the American Army are being called for in very heavy tonnage.

Plan Rural Motor Express Lines in New York State

The need of rural express lines in New York State to relieve the congestion on the railroads is the reason given for the appointment of a highways transport committee of the New York State Defence Council. It is a result of a recommendation of the Council of National Defense and the council says in a recent bulletin: "In view of the war demands upon railroad transportation, the authorities at Washington state that all possible agencies of transportation should be developed and this movement will have their support, as well as the aid of the automobile truck industry." Samuel A. Miles, chairman of the motor truck committees of the National Automobile Chamber of Commerce, has been in conference with various road and automobile authorities of the state and has gone over the situation. The scope of the plan is such that if carried out it will result in the establishment of truck express lines operating in every county.

Business Notes

The Siems-Carey Co., New York, has opened local offices in Seattle, in the L. C. Smith Building. W. F. Carey is in charge of the Seattle branch. The firm is at present engaged in the construction of 40 miles of railroad into the western Clallam County spruce belt and connecting these lines with the present Milwaukee lines at Port Angeles. The Siems-Carey Co. is to furnish the Government with 300,000,000 ft. of spruce from this section in one year for airplane construction. The firm will build the railroad and mills and establish logging camps.

The Todd Dry Docks, Inc., Seattle, Wash., recently filed articles of incorporation. The company is capitalized at $1,000,000, to engage in the operation of dry docks, engine and ship building. Work has been started on a large repair plant on Harbor Island, Seattle, where three big dry docks are planned. The incorporators are H. W. Kent, formerly vice-president of the Seattle Construction & Dry Dock Co., formerly owned by the Todd Co.; Judge William H. Bogle and F. T. Merritt.

The American Steel Export Co. has just announced the appointment of Philippe Berger, 2 Square de l'Opera, Paris, as its general agent for France and Belgium. This company recently announced the opening of a branch office at Rio de Janeiro, with J. D. W. Snowden as manager.

The Aspromet Co. of Pittsburgh (formerly the Asbestos Protected Metal Co.) announces the removal of its Chicago office on July 1 to the Railway Exchange Building. J. T. O'Neill will continue in charge as district manager.

P. B. Findley, formerly technical editor in the department of publicity, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Penn., has resigned from that company and is now in the training school, University of Pittsburgh, taking a special course in radio work with the Signal Corps. Prior to his connection with the Westinghouse Co. Mr. Findley was editor of the *Electrical Age*.

William T. Summers, of the Merchants' National Bank of San Francisco, has been elected vice-president of the Judson Manufacturing Co., Oakland. W. L. Booth has been appointed general manager of the company, succeeding W. D. Bunker.

D. W. Thurston, formerly superintendent for the Bates and Rogers Co., Chicago, Ill., has resigned to accept the superintendency of the John F. Casey Co., Pittsburgh, and will have charge of the Pennsylvania R. R. work at Sharpsburg, Pa. H. H. Sabin, formerly office manager for Bates & Rogers, in Chicago, will act in the same capacity for the John F. Casey Co., under Mr. Thurston.

C. A. Hall has been appointed manager of the electric light and power department of the Eastern Pennsylvania Railways Co., Pottsville, Penn., which is operated by the J. G. White Management Corporation, New York City.

A. Niedermeyer, formerly works manager of the Snow-Holly Works of the Worthington Pump and Machinery Corporation, has resigned to go into business for himself.

Trade Publications

"Austin Motor Road Rollers" is the title of a catalog received from the Austin-Western Road Machinery Co., Chicago, Ill. It is a 9 x 12 paper-covered book, giving complete description and illustrations of the road rollers manufactured by this company and using gasoline, kerosene and distillate. It also gives illustrations of the various parts of the engine, and catalogues machinery used in connection with road rollers, such as scrapers, scarifiers, etc.

"The Potentiometer System of Pyrometry and Temperature Control" is the title of a 60-p., 8 x 10½-in. catalog, published by the Leeds & Northrup Co., Philadelphia. It describes a system of pyrometry and temperature control in which the potentiometer method is employed for measuring the electromotive force of thermocouples. It is illustrated with many half tones, line cuts and diagrams and contains much information in this line.

The Hastings Pavement Co., 25 Broad St., New York, has issued a 12-p. catalog describing and illustrating the "Asphalt Block Industrial Floors" produced by the company. The pamphlet reprints "An Improved Floor Material for Shops and Warehouses," recently published in Bulletin 29, Public Works of the Navy.

Bulletin No. 9 of the Wellman-Seaver-Morgan Co., Cleveland, describes the W. S. M. car dumper. It is a 7-p. pamphlet illustrated by photographs and line cuts, and gives complete information, together with diagrams, regarding the handling of cars by this method.

The Bastian-Blessing Co., Chicago, Ill., has issued a catalog of the "Rego" line of welding and cutting apparatus, lead-burning equipment, regulators, etc., a loose-leaf paper-bound publication illustrating the machines and accessories manufactured by the company.

Irrigation Supplies Catalog No. 11, a booklet of 123 pages issued by the R. Hardesty Manufacturing Co., Denver, Colo., contains useful tables, curves, diagrams and other irrigation data.

The Iron Trade Review together with the *Daily Iron Trade and Metal Market Report* have issued a 75-p. paper-covered pamphlet in which they have compiled a complete list of base prices, differentials and extras on iron, steel and nonferrous metallic products, fixed under Government supervision.